SUSTAINABLE DESIGN FOR TWO MAINE ISLANDS

A study conducted by: The Institute for Energy Conscious Design Boston Architectural Center

Sustainable Design For Two Maine Islands Final Report

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Bernie LaCasse

Leslie Horst

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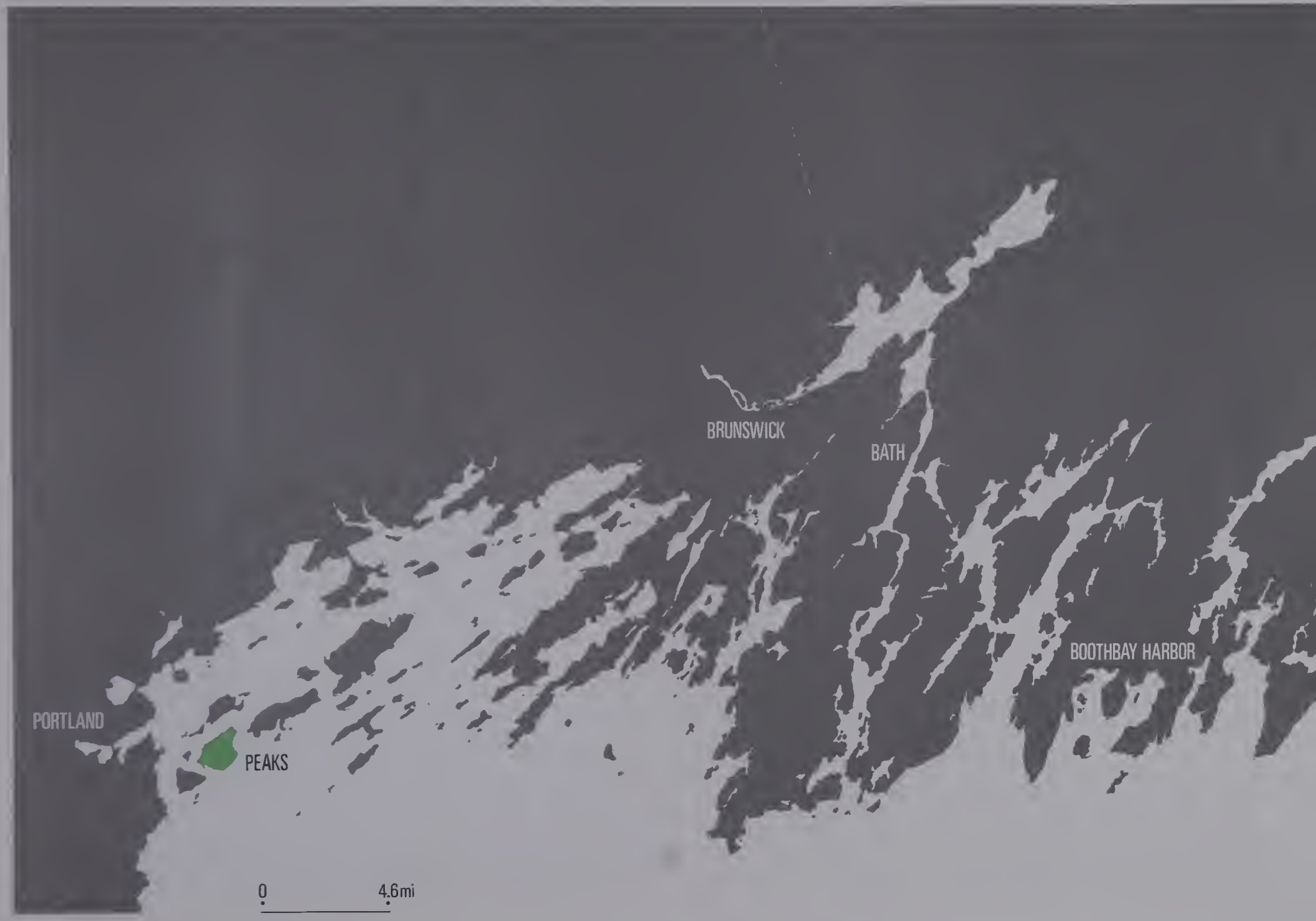
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Bernie LaCasse

Sustainable Design For Two Maine Islands

Final Report

A study conducted by:
The Institute for Energy Conscious Design
Boston Architectural Center

Funded by:
The Bird Companies Foundation

Program Chairperson:
John S. Crowley

Advisory Board Chairperson:
Sarah P. Harkness

Report edited by:
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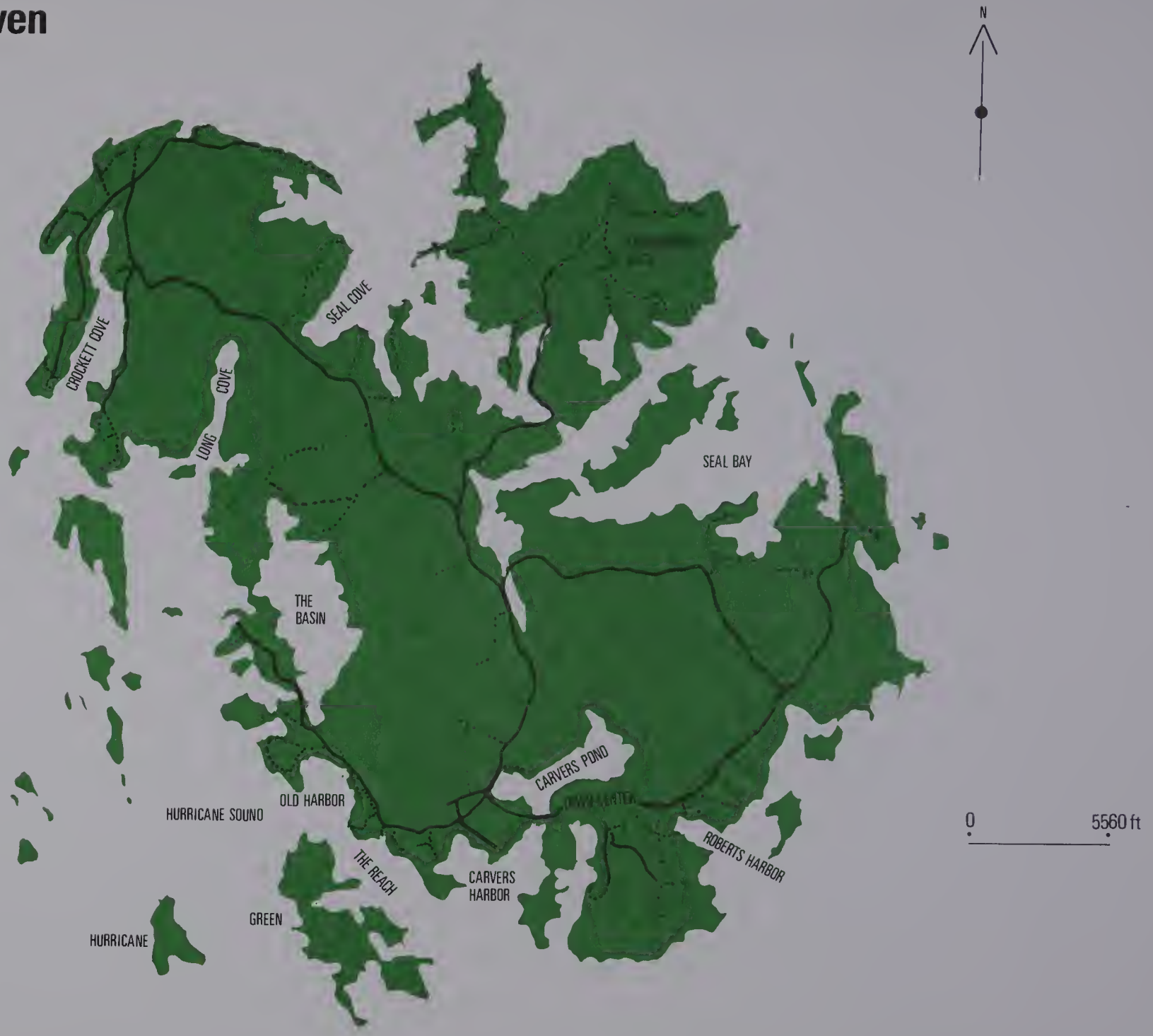
Peaks Island

Vinalhaven



Bernie LaCasse

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I Foreword

Leslie Horst and Sarah P. Harkness

It is with a sense of joy–and relief–that we finish editing this final report on the Maine Islands Design-In, almost one year after the weekend itself. Our work in assembling and editing this report, as well as the writing contained herein, has been done almost entirely on a "spare time basis"–for most people this time has also been unpaid. We are impressed with the hard work and commitment of our colleagues and we are inspired by the sheer volume and visual excitement of the drawings produced in one, intensive three day period. We offer this product to the design community and to interested others in the hope that work on the critical issue of sustainable community design will, itself, be sustainable.

May 1985

Dick Morehouse

II The Institute for Energy Conscious Design

"The purpose of founding the Institute was to help create a smooth transition to a built environment which is both energy efficient and responsive to human needs."

Leslie Horst

In 1982, with the help of the Bird Companies Foundation, the Boston Architectural Center established the Institute for Energy Conscious Design. The Institute was founded in order to help create a smooth transition to a built environment which is both energy efficient and responsive to human needs for quality and comfort in buildings. The Institute's philosophy and operation have derived from the conviction that design must be energy conscious in order to achieve true excellence.

The Institute was planned as a regional center; concentrating on the unique setting of New England, it was designed to serve the professional and larger citizen and business communities through information and programs in support of energy conscious design. It has done this work in three major ways: providing an opportunity for expansion and innovation in the curriculum of the Boston Architectural Center's School of Architecture; operating a library/resource center which provides in-depth information on selected topics related to energy conscious design; and presenting lectures, seminars, and special events. The library/resource center has as its core the 10,000 volume collection which previously belonged to the Northeast Solar Energy Center. The Institute received a small grant from the Department of Energy to assist in the transfer of the collection after NESEC was closed.

In its first year of operation the Institute presented a program on energy efficient office building design which featured case studies of such notable examples as Enerplex in Princeton, New Jersey, and the CIGNA building in Bloomfield, Connecticut. Jointly with MIT's Laboratory of Architecture and Planning it also convened a series of special roundtable sessions on environmental quality within buildings and sponsored a course at the BAC on daylighting design.

In the spring of 1983 the Institute sponsored seven seminars on topics such as glazing design and the avoidance of failures; atrium design in buildings; energy efficient office building design; multi-family housing; and indoor environmental quality. BAC students could enroll for a course in conjunction with this series of seminars.

In the fall of 1983 the Institute's work focused on the important topic of affordable, energy efficient, multi-family housing. Four public seminars were offered as well as a related studio course for BAC students. On a consultant basis, the Institute also designed and presented a program on energy efficient design in order for New England Electric to disseminate the results of its energy efficient home contest.

Long before the program described in this report took place, the Institute became interested in the issue of local and regional sustainability. It became clear that energy efficient design of buildings was by itself not sufficient. Design approaches which acknowledge the interconnectedness of buildings, agriculture, waste management, water supply, transportation, and indigenous energy resources were needed. The purpose of the program described herein was to advance this theoretical perspective and take it to the level of practical possibility.

"It became clear that energy efficient design of buildings by itself was not enough."

For its entire history, the Institute for Energy Conscious Design has received funding from the Bird Companies Foundation. Unfortunately, Bird is no longer in a position to fund the Institute's efforts; thus the roundtables, Design-In, and final report will be the last separately funded activities of the Institute unless future funding sources can be found. The Institute will continue to be listed as a program of the Boston Architectural Center, and the library/resource center continues to be maintained as part of the BAC's Library. Of equal importance is the fact that its philosophy and approach will be carried on by all of those who have taken an active part in its programs.

Sustainability is an ecological concept with economic implications... A sustainable society is one that shapes its economic and social systems so that natural resources and life-support systems are maintained.

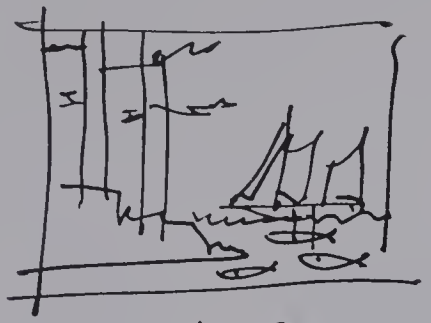
Lester R. Brown, President Worldwatch Institute, quoted in the New Alchemy Quarterly, Summer 1984

Sustainable design implies a balanced relationship between human activities and the natural environment... It is generally accepted that environmental quality is directly related to... quality of life, even if it is not measured in "the standard of living".

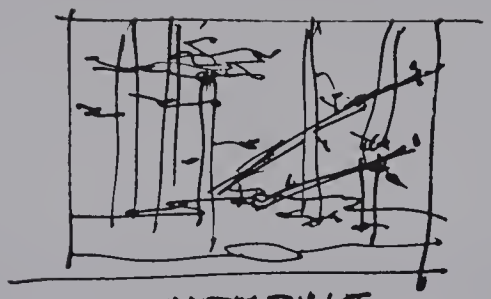
Albert Presgraves, Water and Waste Issues (this report)

SUSTAINABILITY AND PROGRESS

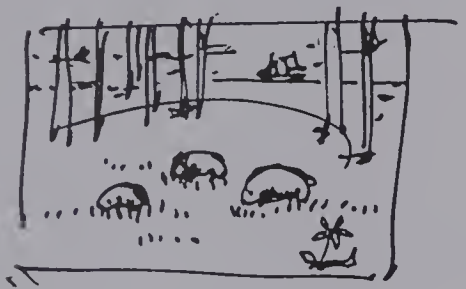
1. TOTAL SELF SUFFICIENCY



2. FISHING

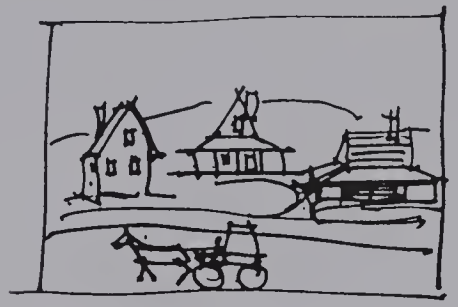


3. LUMBERING BOAT BUILDING



4. SHEEP FARMING

5. SUMMER RESIDENTS



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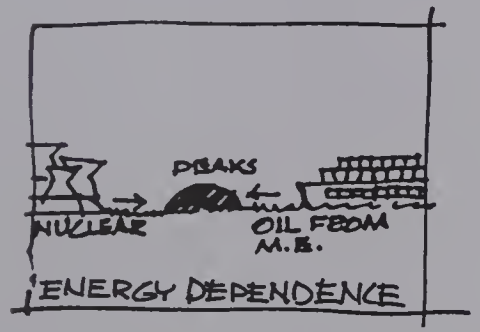
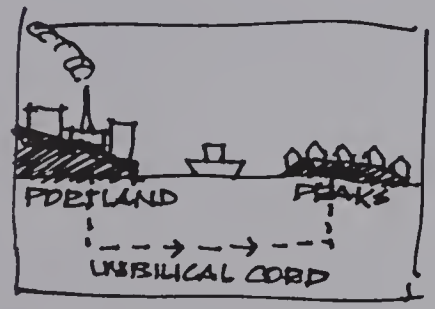
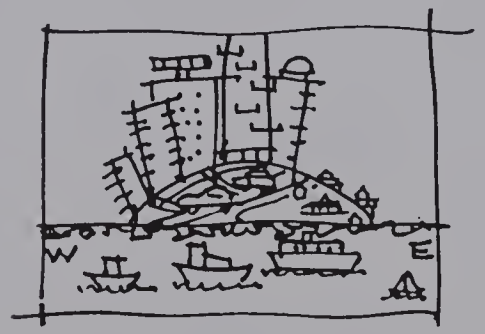






7. UNCONTROLLED GROWTH

Sally Harkness

III Introductions

Sustainability

Sarah P. Harkness

The issue of sustainability brings a rearrangement of priorities to the planning process. Solutions for survival into the future take precedence over quick fixes. The assumption is that survival will eventually depend on finding ecological balance, and, therefore, that ecological balance is the ultimate determinant of economic values.

The planning process begins with the small – the individual and the local – and works outwards from there. As Gordon Tully says, "If you can solve a problem at a small scale, do so, even if it is somewhat less efficient;" but, as Philip Conkling writes on the subject of inter-island cooperation, "the rugged individualism of an isolated existence works only if it is tempered by cooperation.

"Sim Van der Ryn, in the report of the Westerbeke Charrette on Sustainable Communities held in 1980, gives a more specific definition of sustainable design.

Sustainability implies some broad principles from an urban design point of view. First, sustainability implies that the use of energy and materials in an urban area be in balance with what the region can supply continuously through natural processes such as photosynthesis, biological decomposition, and the biogeochemical processes that support life. The immediate implications of this principle are a vastly reduced energy budget for cities, and a smaller, more compact urban pattern interspersed with productive areas to collect energy, grow crops for food, fiber and energy, and recycle wastes. New urban technologies will become less dependent on fossil fuels and rely more on a careful integration with biological processes. For example, organic wastes, including sewage and decomposable materials, can be recycled back into the soil rather than, as is the rule today, be dumped into oceans, burned, or used for landfills. Non-renewable materials and metals will be recycled. The design of urban support systems will be tied more intimately to the regional resource base rather than depending on global supply lines which are stretched to the limit. Cities will begin to rely on their regional ecosystems to produce most of the food and water consumed. This will mean cities of far greater diversity than we have today, with each region developing unique urban forms based on regional characteristics that have long been overridden by cheap energy, which is a great leveler of regional diversity and the unique character of place.

Perry Chapman has broadened the concept to regional sustainability in his paper for the 1982 Woodlands Conference, **The Mature Region: Building a Practical Model for the Transition to the Sustainable Society.** In this paper, he defines the three foundations of New England, which he calls "the first steady-state region in the U.S.," as 1) "A variegated landscape of forests, farms, rivers and coasts;" 2) "A settlement pattern of compact, closely spaced centers;" and 3) "An educational complex that forms the economic bedrock of New England." The article considers in what ways the "three foundations" can be marshalled to promote regional sustainability.

"Sustainable Design" is a natural sequitur to "energy-conscious design" for individual buildings. In commercial buildings as well as housing, energy efficiency is now expected through the use of passive solar techniques, natural ventilation, daylighting, and improved mechanical systems. But the energy problems of individual buildings are only a part of the transition toward a stable future. Transportation, methods of food growing and distribution, and waste disposal and re-use were the subjects that came up most often at the Maine Islands Design-In.

Some examples of what sustainability is not might be helpful. The inscription over the entrance of the College of Engineering, University of Wyoming, reads: STRIVE ON. CONTROL OF NATURE IS WON, NOT GIVEN. The notion that nature can be conquered is rarely, if ever, sustainable.

In present day food production in the U.S., 15-20 calories of fossil fuel energy are invested for each calorie of corn energy delivered to the local market. Artificially synthesized hydroponic solutions can require 50 calories of energy to produce one calorie of food. Long distance food supply systems require 12-15 calories of energy per calorie of food for packaging and distribution (See Roundtable #5, Gary Hirshberg). No wonder that transportation accounts for approximately 25% of what you pay at the grocery store.

In discussing "sustainability" at the Design-In, someone said, "How about a casino for Peaks Island? Wouldn't that offer sustainability for some time to come?" That's just not the kind of sustainability we're talking about.

The architectural community has not yet absorbed the term "sustainability" into its vocabulary. On hearing the word, a first reac-

"The issue of sustainability brings a rearrangement of priorities to the planning process."

"if you can solve a problem at a small scale, do so, even if it is somewhat less efficient;"

tion is to connect it with "preservation" – preservation of the status quo. But neither present-day nor old-time systems are necessarily sustainable; some are and some are not. So "sustainability" has no historical meaning; solutions will change over time, and will not be universal. A case in point is a comparison of the recommendations that were made for sustainability in Vinalhaven and Peaks Island. In Vinalhaven, a very substantial increase in population was advised; for Peaks Island, while an increase was also recommended (and expected), there was concern that the island may become over-populated. (An interesting note is that the summertime increase in population on Peaks Island works in very well with the agriculture and waste systems that are suitable to that climate.)

There have been periods of time in North America when human systems obtained a degree of sustainability. The Indians of North America, who apologized to mother earth before they cut into her, existed in a balance with nature that "civilized" societies cannot emulate. However, the city of Lowell was also an early example of a sustainable system. With an energy base of water power to drive the textile mills, the system extended to New England shipping, where timber, ships and textiles were exported, with hides and wool returning for the mills (see Roundtable #I, Perry Chapman). The Lowell experiment was also a social one with high moral overtones. A "clean" life for the young women who worked in the mills was combined with industrialization to create the "celestial city" that people from far and near came to see. The working conditions (12 hours a day, six days a week, with average pay of $1.00 to $2.00 per week) did not, however, remain sustainable. (See *Boston, City on a Hill*, by Andrew Buni and Alan Rogers). The goal of sustainability is a moving target. Even if it is never entirely reached, it can be approached.

The use of design as a research tool to investigate a topic like sustainability offers a great deal more than the purely scientific method. It can use intuition, or even flights of fancy, as well as deductions from facts and figures. It brings the options to life and relates one set of options with other sets, so that everyone can visualize what would happen if…And finally, the design process is **cheap**. It uses paper and brains, which are far less expensive than built mistakes.

Some earlier examples inspired the Maine Islands Design-In. The R/UDAT program of the Urban Design and Planning Committee of the AIA has used the design "charrette" process to address urban problems in cities and towns. At the request of a local government, community organization or AIA chapter, a "Regional/Urban Design Assistance Team" of architects, planners and experts in other disciplines is assembled to address the problem on site for an intensive four day workshop. A closer prototype to the Maine Islands Design-In was the Westerbeke Charrette on Sustainable Communities, conducted in 1980 by Van der Ryn Calthorpe Matthews, Architects. The Westerbeke Charrette, while using data collected on each of the subject locations, took place in a remote setting, and "blue sky" thinking was encouraged. If the R/UDAT program, very much tied to pragmatic realities, could then be called "grey sky" thinking, perhaps the Maine Islands Design-In was "pink sky."

In actual fact, it rained torrents and the weather was unseasonably cold on Peaks Island for the entire three days of the Design-In. But the spirits of the participants were definitely pink sky. Dressed in heavy sweaters, even though it was June, they laughed as they dumped buckets of water out the window from the leaking roof of the Fifth Maine Regiment Building. For architects and other dreamers, an intense design-in such as this offers a break which is inspiring and just plain fun.

Michael Pittas, formerly Director of the Design Arts Program of the National Endowment for the Arts, said in a recent lecture on "The Design Imperative: the Need for the Visionary in Planning for the Future:"

"…the question is not what *will* the future be, but what *might* it be. There is a critical difference. For the question of what *will* the future be implies the exercise of purely rational faculties. It calls for trend analysis, projection, extrapolation, probability curves, and a host of other techno-scientific, delphic processes.

"A view of what might be is not constrained in these ways. It requires that intuition and creativity be exercised, along with reason. And thus, it opens the arena of inquiry from the realm of the probable to the realm of the possible. And the visionary concepts that emerge come as a result of the designer extending his/her thought beyond the limits of extrapolative processes into the realm of the hypothetical, into the realm of the 'dream.'

"The experience of the Maine islands in the 20th century is fundamentally different from that of most other states in the country."

The Historical, Cultural and Biological Significance of the Maine Islands

Philip W. Conkling

"I want the dream back. And I think we can get it back. Now – right now – is the time for designers to start thinking cosmically, rather than cosmetically. We need the inspiration of great visions again, visions solidly based on human values."

There are approximately 3,500 islands off the coast of Maine, comprising approximately 300,000 acres. Maine's island heritage ranks behind only three other states – Florida, Alaska, and Louisiana – in total number and total acreage. The vast majority of Alaska's islands are remote and inaccessible. Florida's islands are primarily mangrove islands, while Louisiana's islands have formed in estuarine areas on shifting substrates. Although all of these islands are of great importance to wildlife, they are generally not suitable to industrial and second home development. Maine's islands, on the other hand, are surrounded by protected waters, are underlain by water-bearing bedrock units, and have sustained hard working, independent maritime based communities for the past four centuries. All of these factors make them attractive to many different kinds of development.

Historical Perspective

Throughout most of Maine's history, the resources of the islands of her coast have been intensively used. Because the islands were easy to defend, they were settled earlier than corresponding portions of the mainland. Damariscotta Island was the first permanent settlement in Maine. At one point during the French and Indian War, the entire white population of Maine ended up on Monhegan Island before being evacuated to Boston. Throughout most of the latter part of the 18th and all of the 19th centuries, favorable routes of access to the Maine islands through deep water channels gave island lumbering, quarrying, farming, marketing, and hunting activities a competitive edge over similar enterprises on the mainland. It is sobering to realize that the once numerous populations of nesting birds such as Great Blue Herons, Eiders, Laughing Gulls and Herring Gulls were entirely eliminated by the beginning of the 20th century. The spruce forests were all but gone and the great fleets of fishing vessels had moved elsewhere. The first three centuries of intensive human use resulted in drastic alteration of the ecosystems of the Maine islands and waters.

The Twentieth Century

The experience of the Maine islands in the 20th century is fundamentally different from that of most other states in the country. Partly as a result of the exhaustion of island resources from over exploitation and partly as a result of the shift in transportation patterns from water to land, the Maine islands fell into a long economic decline. The decline of island populations and economic opportunities in combination with aggressive conservation activities has resulted in the emergence of Maine's islands as one of the few intact coastal island ecosystems in America.

Most all of the life and livelihood of Maine's islands depends on the extraordinary productivity of the Gulf of Maine. Because the Gulf is a relatively shallow, partially enclosed sea and is fed by the nutrient rich Labrador Current which upwells over outer and inner banks, a highly productive and complex food web has developed to support the diversity of life associated with the Maine islands. As one measure of this productivity, approximately one out of every five pounds of fish caught commercially last year came from Gulf of Maine waters.

At a time when we as a society are placing unprecedented demands on our thin strip of coastal land and resources, Maine's islands

"Tides are more important than daylight or darkness in determining when one comes and goes."

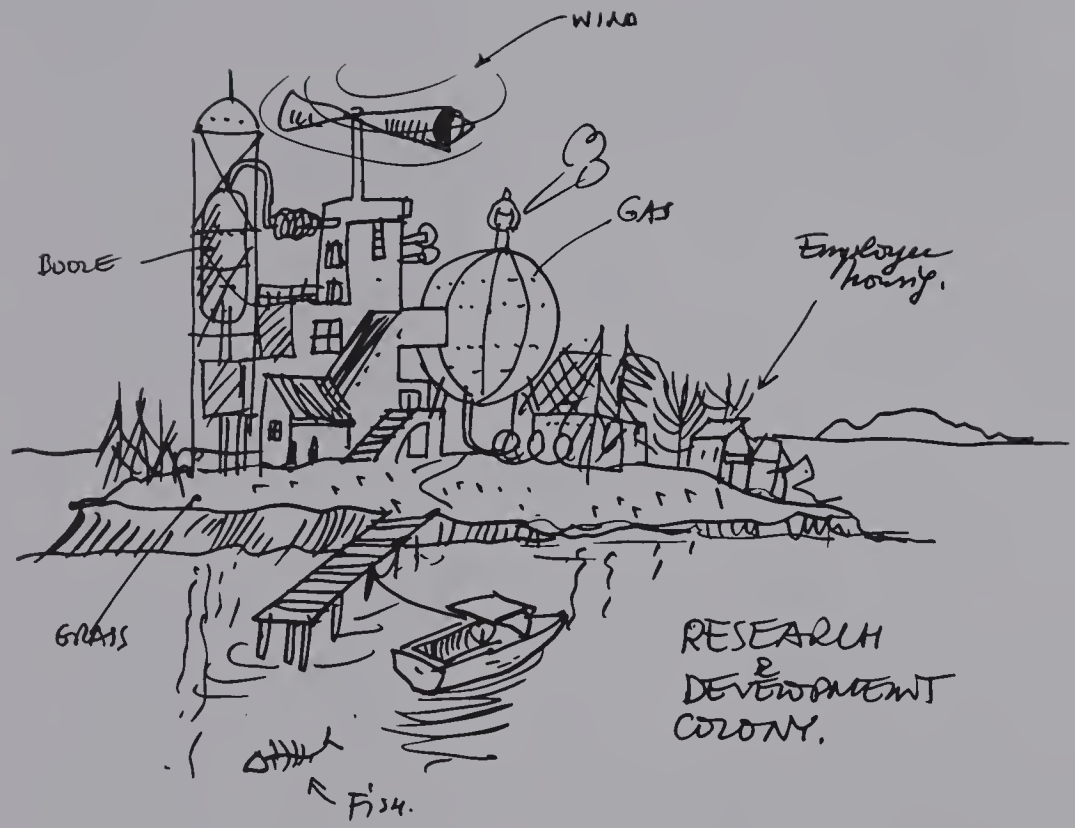
"Sixty percent of the population of the United States lives within a day's drive of the Maine coast."

stand out as uniquely undeveloped. Only one percent of our islands support year round communities, and fewer than 20% have seasonal residences on them. Today, such species as Great Blue Herons, Double Crested Cormorants, Common Eiders and Ospreys nest in numbers approaching their precolonial population levels on Maine islands; populations of Bald Eagles and Peregrine Falcons are showing encouraging signs of rebounding.

The Maine islands have always supported a wide variety of nationally significant plants and animals. The islands of eastern Maine are the southernmost locations for such species as Roseroot Stonecrop, Hooker's Iris, Marsh Felwort, Seaside Harebells, Bird's Eye Primrose, and Baked-Apple Berry. The islands support the southernmost nesting populations of Leach's Petrels, Great Cormorants, Arctic Terns, Atlantic Puffins, Razorbills and Black Guillemots. These species exist nowhere else in the eastern United States. At the same time, the Maine Islands also represent the northern breeding limit of such species as Snowy Egrets, Glossy Ibis, Little Blue Herons and the only cold water populations of Laughing Gulls. Virtually the entire New England population of Great Blue Herons nests on Maine islands for lack of suitable habitat elsewhere.

The Future Outlook for the Maine Islands

Few people who are familiar with the spectacular beauty and diverse resources associated with the Maine islands question the likelihood that they will come under increasing residential, commercial and industrial development pressure as we approach the end of this century and the beginning of the next. Sixty percent of



Jacek Von Henneberg

the population of the United States lives within a day's drive of the Maine coast. The National Park Service projected that in 1983, 3.7 million people would visit Acadia National Park – one of only four parks in the national system located primarily on islands. The deep water off the Maine coast and islands is found nowhere else on the Eastern Seaboard. In fact, Maine is the only place north of Rio de Janeiro that ships over 40′ in draft are able to navigate coastal waters.

The Maine islands comprise one of the most privately owned coastlines in the United States. Until the second decade of the 20th century, the official policy of the State of Maine was to sell all islands under State ownership. Aside from the limited number of acres owned by the U.S. Fish and Wildlife Service and Acadia National Park, the federal government has played a minor role in the ownership of Maine islands.

Private non-profit organizations like The Nature Conservancy, the National Audubon Society and the Maine Audubon Society have acquired an impressive number of ecologically significant Maine islands. The Maine Coast Heritage Trust has established a successful program whereby residential development rights on Maine islands and coastlines are donated to conservation organizations or government agencies in perpetuity. This has helped protect some islands which otherwise would be threatened by highly destructive future incremental, fractional development.

But there remains the question of what will happen to the other resources not restricted by conservation efforts and what relationship those resources will have to the economic base of year round communities. The fact remains that there are presently few, if any, broad based interests able to manage many of Maine's significant island resources. Because the islands are finite in number and are highly romantic landscapes, the islands' future will be controlled by absentee second home development pressures unless ways to encourage the development of traditional natural resource based island economics can be found through cooperative efforts between the islands' seasonal and year round residents.

The Island Communities

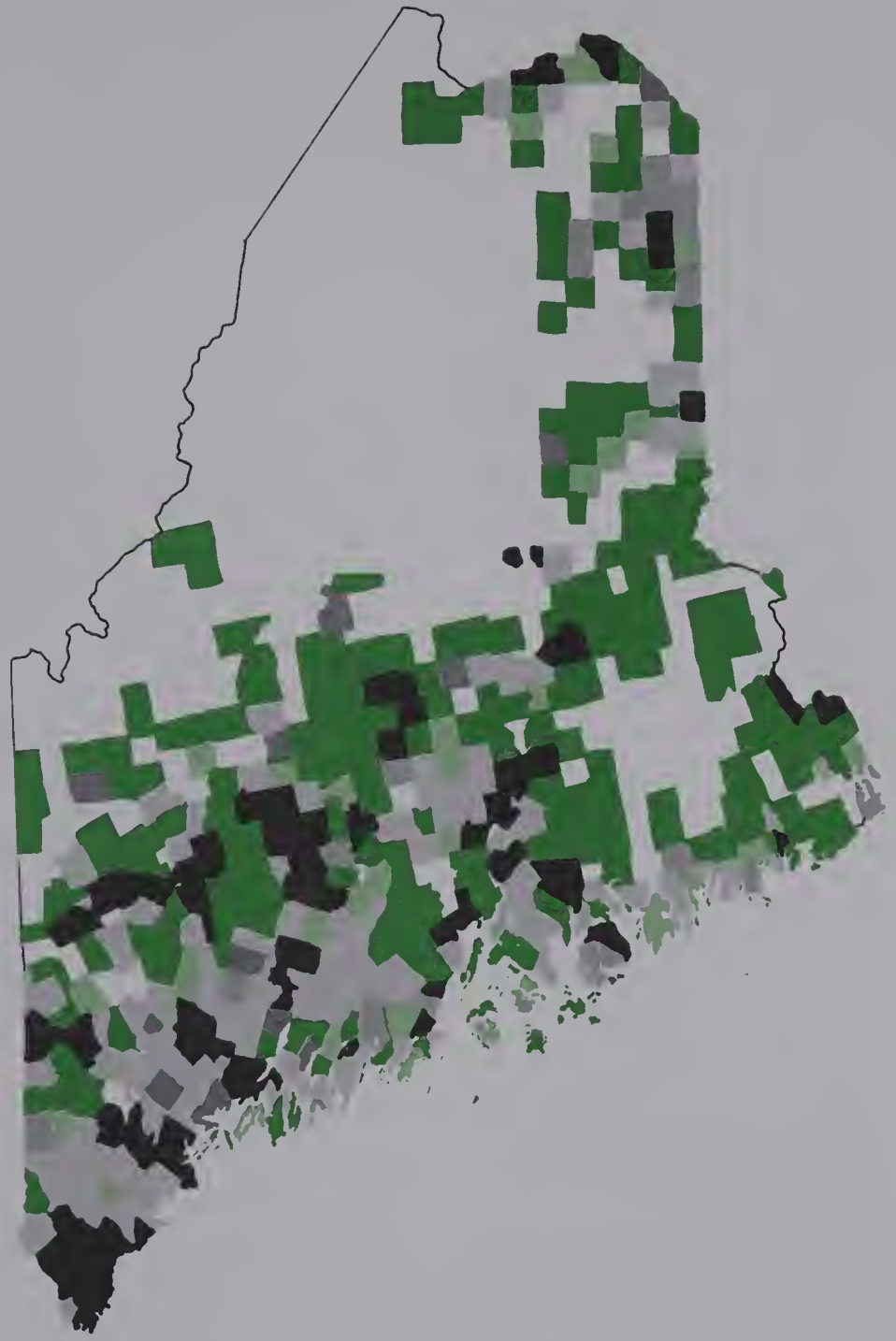
The Maine island communities are composed of people from disparate backgrounds. Their combined population varies from a rough estimate of 8,000 in the winter (including such islands connected by bridges as Deer Isle and Mount Desert) to four times this level in the summer.

Islanders from many walks of life share values and perspectives by virtue of the demands island living imposes on one's life style. Tides are more important than daylight or darkness in determining when one comes and goes. Island living must be simple and must make do with what is available. Handiness with small boats is not just a pastime but can mean the difference between life and death.

In the days of merchant sail, news of common interest was carried between islands on the lips of vessels' captains and crews which not only enriched the social fabric of island communities but also was a means of transmitting vital, practical information. Today we need to find other means of transmitting information from island to island that establishes the value of the biological, historical and cultural resources of Maine's islands. We also need to establish links between island communities to understand and celebrate the values and traditions that make them not only unique, but also mutually interdependent. One of the supreme ironies of island life is that the rugged individualism of an isolated existence works only if it is tempered by cooperation. We are thrust together on these rocks whether in family groups or in a larger community and are reminded often and forcefully of the need to get along, to work together, to share scarce resources, and to rediscover continually that no man is an island.

"One of the supreme ironies of island life is that the rugged individualism of an isolated existence works only if it is tempered by cooperation."

"Immigrants caused a boom in self-sufficient agriculture that peaked about 1880 with 20 million acres under cultivation, compared with five million today."


TRADE & EMPLOYMENT CENTERS
SATELLITE CENTERS (SECONDARY TRADE CENTERS)
PRIMARY INDUSTRY TRADE CENTERS (FARMING & FISHING COMMUNITIES WITH SUBSTANTIAL RETAIL TRADE SECTORS)
SUBURBAN (COMMUTER) TOWNS
RURAL FRINGE OF SUBURBAN AREAS
FARMING & FISHING COMMUNITIES

IV Roundtables

Summarized by Gordon Tully

Sustainability in New England

M. Perry Chapman

January 31, 1984

There is need and an opportunity to restore self-reliance as a cultural ethic in New England. Design professionals have a large stake in making sustainability work, and New England is an ideal subject as the first "steady-state" region in the U.S.

We have precedents and recurrent themes from the past, such as settlement patterns of the 17th and 18th centuries. The Revolution was a dramatic adventure in self-reliance. In the 19th century, the experiment in Lowell was an example of using an investment opportunity to create a self-contained system focussed on energy. The experiment was repeated in dozens of mill towns, creating an industrial "sun-belt" development. The self-contained system extended to shipping, in which timber, ships and textiles were exported and hides and wool returned.

Immigrants caused a boom in self-sufficient agriculture that peaked about 1880 with 20 million acres under cultivation, compared with five million today.

An intellectual flowering occurred in the mid-19th century. And, as industry waned, the country's first public infrastructure appeared. Frederick Law Olmstead and Charles Eliot used public funds to create great parks—a natural system that became a key regional feature.

This mid-century balance proved precarious as other places became more desirable for manufacturing and crops and New England resources became limited. Importing new resources such as oil became important. However, commercialism went overboard. Overcutting caused disastrous erosion, and resultant flooding often destroyed mill machinery. No wilderness was put into the public domain until the 20th century, when Week's Law created the Green and White Mountain National Forests.

The following suggestions regarding New England's current "steady-state" condition were offered:

We have a stable population, slightly in decline, with decelerating emigration. The baby boomers of the '40's and '50's will not spawn a significant mini-boom in the '80's. Education, rather than population, is the key to New England's future, but education's traditional population base is also declining. Its base must be broadened as lifetime education and training for career changes become more necessary.

We need to come to terms with resource limits through a conservation movement. Losing our resource-hungry "smokestack" industries will make this easier.

We must modify the idea that a "mature region" is one that is drying up (as described in Neil Peirce's work). Peirce believes that a "mature region" exports capital, loses its entrepreneurial "juices," and loses its desire to take risks. On the contrary, New England *can* maintain strong entrepreneurship, despite some export of capital and possibly lessened risk-taking.

We need a regional sense of priorities that spurns quick fixes. This especially concerns decisions about the coastline.

A successful experiment in sustainability in New England is significant. As the rest of the U.S. reaches its own "crunch point" as a mature region over the next 50 years, New England can be a model for solutions. Many industrial jobs will be replaced by new technology; in 1979, the average age of industrial equipment was seven years, and much of it was energy inefficient. Multiple demands on available resources, particularly water, will require hard choices in growth regions. We have reached the threshold in New England. We must become less dependent on other regions, and save our resources and our environment as well.

Needs for New England in the year 2000

We must achieve a higher degree of energy self-reliance for survival. We import 75% of our energy, compared with 43% for the U.S. as a whole. Oil supplies are diminishing, and thus we need to reserve it for lubrication and chemicals. Coal is similarly needed for these purposes. Technical fixes are unreliable; we were the first to adopt nuclear power, but now Seabrook 2 may be cancelled. One implication is that New England must move toward the use of indigenous sources of energy in order to reduce our vulnerability to energy supply interruptions.

We need a more diverse and self-sufficient food supply. We import 80 to 90% of our food, and have only one week of storage. Our food costs 10 to 15% more than in the rest of the nation. As California runs out of water and Florida runs out of land, we will be competing for this dwindling food supply.

We need a more diverse job market. Chronic unemployment plagues the old mill towns in the northern tier counties. Half our companies have headquarters outside the region, and we are vulnerable to plant closings.

Perry Chapman has a Bachelor of Architecture degree from Cornell University. His background is primarily in planning and project management. This talk initiated the roundtable series and introduced many of the issues to be considered throughout the series and at the Design-In itself. His earlier paper on sustainability won the Mitchell Energy Award. Currently Chapman is conducting an in-depth investigation of sustainability with the aid of a practitioner fellowship from the Lincoln Institute of Land Policy.

"As the rest of the U.S. reaches its own 'crunch point' as a mature region over the next 50 years, New England can be a model for solutions."

"We import 75% of our energy, compared with 43% for the U.S. as a whole."

We must conserve nature and manmade settings. Much of our real income is from the land and seascape, which are also a "psychic tonic." We have a unique settlement pattern that is mostly in place. There are old mills and factories ready to reuse. Vehicle mileage per capita is one-third to one-half that of Los Angeles. If we allow sprawl, we will kill the land and energy advantages we have inherited.

Cultural Resources

New England has three cultural characteristics that can be seen as resources.

We have a long tradition of "making do". After 18 generations, "hanging tough" has developed into a cultural ethic, shared by mud-flat diggers, wood cutters and other hardy types. We can and do enjoy luxuries, but we also enjoy a good bout of "making do." We cut 6 1/2% from our energy consumption in 1978-80 – three times the national average. From 1976 to 1983, we cut 35% from our oil consumption. We could now achieve up to 25% of our energy from indigenous sources.

We have a labor force that is willing to accept 10% lower pay in order to live here. A high percentage of the population works; there are more working families and part-time workers than elsewhere in the country. In the next 20 years there will be a huge surge of seasoned workers as the baby boom matures. These people must have jobs, and must in many cases be retrained.

We have a unique educational/entrepreneurial/technological complex, centered on M.I.T. We have 260 colleges and universities plus many other medical and research facilities in the region. Our educational resources attract people from the rest of the U.S. and the world. This creates a transfusion of new ideas – a predictable, incremental flow of innovation. The technology spawned by this flow creates new industry. We are unusually dependent upon high-tech industry, and will become more so in the next decades. This is not without negatives, but it is a key to our prosperity.

An "off-the-wall", borrowed theory is proposed: "Two-technology fallout." First, there is mainstream high-tech industry – biogenetics, robotics, computers, etc. Secondly, there is the alternative enterprise technology, a small craft industry created by people who came here to school and stayed to start small organizations such as Eastern Mountain Sports and Vermont Castings. This eclectic industrial mix is important in creating diversity and reaching outlying regions. It adds interest and dimension, and may be our "diamond in the rough."

We now have a two-tiered region consisting of megalopolis and upland. We must be sensitive to this contrast. Of the 15 million New Englanders, three-quarters are squeezed into the coastal belt from Portland, Maine to Fairfield, Connecticut. Furthermore, the region is an economic "crazy-quilt" that places depressed areas close to very high employment areas. Affluent second homes are mixed with slums in New Bedford, Pawtucket and other post-depression towns. These contrasts lock New England regions into urban/rural interdependence.

Discussion

The first major topic was the use of New England's woodlands. Industrialized tree-cutting is widely regarded as ugly. It is resisted despite the fact that 80% of our land is now forested (vs. 50% in the 19th century). Various techniques for making cutting less destructive (e.g., whole-tree harvesting with replanting, finding new uses for "junk" trees, etc.) were mentioned, but the problem is not easily solved. Phil Conkling suggested that we may need to learn to see tree stubble as "beautiful" in the same way that corn stubble is often viewed. Nevertheless, we need two kinds of forest: forever-wild, and farmed.

"We have a long tradition of 'making do.' After 18 generations, 'hanging tough' has developed into a cultural ethic..."

Hydro power is no easy alternative either. Entrenched opposition to new hydro is at least as strong as the resistance to Seabrook. Recreational use of wild rivers is seen as vitally important. This issue will generate even more conflict when oil prices rise again.

Further discussion ranged widely and included the following issues:

New England is perhaps the most knowledge-intensive region in the world, but we are in an increasingly competitive era brought about by the nationwide educational reform movement.

With appropriate planning, higher education can assist in technology transfer and provide continuing education.

The schools could play a role in developing a more sophisticated and less propagandistic view of environmental issues.

High-tech is *not* the sole "wave of the future." In fact, the Bureau of Labor Statistics has projected a relatively small number of high-tech jobs.

Various aspects of planning were discussed: its general lack of success; its often reactive nature; the use of high-powered forecasting; "mega-

trend" observations; northern New Englanders' suspiciousness of planning; and the investment of private companies in towns (e.g., Wang in Lowell).

Rapid growth has been the dominant metaphor for a long time. Gordon Tully pointed out that "sustainability" as a concept and an approach needs a new vocabulary and greater clarity in order to be accepted as a new metaphor that will influence planning decisions.

Peaks Island in the Casco Bay

John Crowley

John Crowley, formerly Director of the Institute for Energy Conscious Design, is the Research Director for the Product Development Division of Ryan Homes. He is also director of the STAR Foundation in Maine, a non-profit organization based on Peaks Island. Through active programs on Peaks Island, STAR Foundation plans to provide a model for the transition to an energy independent, sustainable future. He suggested that Peaks Island was an ideal focus for the Design-In.

Peaks Island is part of the city of Portland, which is undergoing a renaissance, particularly with regard to its old buildings. This city of 61,000 occupies 15,000 acres, and has a metropolitan population of 150,000. Its older section is a haven for artists and craftsmen – a kind of Newburyport. This activity near the waterfront is leading to development pressures in Casco Bay.

The Bay contains the "Calendar Islands", so called because there are 360 of them. The islands have a rich past. However, the five islands nearest Portland declined after about 1900, when steamboats stopped serving them.

At their peak, the islands hosted a variety of resort activities that drew people from throughout the region to the Casco Bay islands. These included a summer stock theater, bowling alleys, shooting ranges, hotels, docks – all of which decayed during the early decades of this century. The passenger train line from Boston to northern New England and the increasing popularity of the automobile were principally responsible for the declining enthusiasm for the islands.

Then, beginning with the depression years, the Portland welfare population was encouraged to take up residence on the islands, particularly Peaks; abandoned housing dating from the turn of the century became their homes. More recently, dwellings left vacant by the departure of military personnel at the conclusion of World War II were made available to needy city residents unable to afford rental payments on the peninsula. The children and grandchildren of these people are now competing with a stream of affluent young people, who in 1981 could buy a home on Peaks Island for as little as $20,000.

There are numerous military fortifications on the Islands, left over from the Civil War and two World Wars. On Great Diamond Island the military buildings (c. 1900) were still completely equipped in 1958. This military reservation with 125 buildings occupying approximately 200 acres, nearly 50% of the island, was a part of the Portland military facility, which during WW II could fuel and supply the entire North Atlantic fleet in just one night. It was recently sold to a Portland-based developer, Dicktar Associates, which plans a large luxury residential community with a projected sales total of $20-30 million.

During the early 1970's the Great Diamond Island facility and a similar installation on Long Island were considered for use as a major deep-water port for supertankers and a petroleum refinery base. The proposal was squelched by the Department of Environmental Protection due to potential ecological damage to the Bay. Today, the Long Island facility, with over 300 acres and two miles of coastal frontage, is a likely site for development similar to that proposed for Great Diamond Island.

Major changes are likely for all the islands within easy commuting distance of downtown Portland. The downtown revival and resultant building boom is placing a great deal of development pressure on the islands of Casco Bay, an interest not seen since the gay nineties nearly a century ago. It suggests an analogy with the development fever which swept Long Island, New York, in the 50's and Cape Cod in the late 60's and 70's. One hopes that the residents of

"Major changes are likely for all the islands within easy commuting distance of downtown Portland."

"The entire Southern Casco Bay area, especially the five island communities within Portland's city boundary, is experiencing a significant influx of year-round residents."

Casco Bay will glean some knowledge from their neighbors to the south in order to avoid critical resource problems resulting from poor planning decisions.

A study recently undertaken by the City of Portland Planning Department and the Council of Governments will propose a land use and zoning classification package for the island neighborhood that will respect its uniquely delicate ecosystem. Issues of density, sewage and refuse disposal, setbacks, conservation zones, recreation, fresh water, fishing, and agriculture are being addressed. The investigators appear to be giving due consideration to the quality and character of island life in the next century.

City government officials who represent the islands reside in and also represent a moderate income neighborhood on the mainland, Munjoy Hill. Such representatives have historically shown little interest in the small islands' residents, viewing them until very recently as second-class citizens and welfare cases. As the island population becomes better organized to carry its demands to the council chamber floor, a more equitable disbursement of city services will result.

The Portland waterfront area is crucial to the islands. It is a deep water port, with three or four tankers at dock on a typical day. It also docks many fishing boats, cruise boats, and steamers.

Departing from this waterfront is the Casco Bay Island Ferry that provides the Peaks Island community with regular service. As the only link to the mainland, it is a key part of the island's social life. It is the funnel through which everyone passes, allowing a rapid exchange of information. The ferry company, which is now operated by a nonprofit transit district, runs an auto ferry twice a week in the winter, but hourly in the summer. Summer visitors bring a lot of cars onto the island.

Peaks Island houses are by and large tightly clustered and in need of repair. New houses cost 20-30% more to build than on the mainland. There is a village with a history of inns. The Fifth Maine building is an historical structure built by Civil War veterans, recently renovated to serve as a community service building.

During the past five years, greatly increased island development has been evident. A significant proportion of the summer homes is being renovated to allow for year-round occupancy. A new food market was completed two years ago. A restaurant/marina facility has been operating for two seasons, and a boutique, deli, hair salon, real estate office and lumber yard have each made their debut during the past twelve months.

A growing year-round population on Peaks Island requires expanded services in a number of areas including daycare, health care, schools, fire and police protection, refuse removal and street maintenance. As a result, the cost of island living is rising, most recently witnessed by a real estate property re-evaluation which caused tax increases as large as 50-60%. Homes which sold for $15-20,000 in 1979 have nearly doubled in market value during the past five years.

The entire Southern Casco Bay area, especially the five island communities within Portland's city boundary, is experiencing a significant influx of year-round residents. As a result, a number of infrastructure problems are beginning to surface. Transportation, fire and emergency medical services, freshwater supply, solid and liquid waste disposal, and land use policies are among the important issues facing the communities. A number of efforts are underway to address these issues: the Casco Bay Area Transit District has recently been restructured to improve ferry service; fire and life safety services are being upgraded; and the island zoning study described above was begun in the spring of 1984.

Solid and liquid waste management remains an issue that local municipal officials have successfully ignored but which is nearing a critical level. Most citizens remain unaware of the issue and its consequences for future development. This situation is not unusual and appears to be the norm for most island and mainland communities throughout northern New England.

Through efforts by the STAR Foundation during the past 12 months, city officials have begun to publicly acknowledge the problem. For example, the city operates dumps on Peaks Island – the bay's most populated island – and Long Island. Neither one meets Department of Environmental Protection (DEP) regulations for waste burial. The Peaks Island landfill, nearly full, is due to be closed next year; alternatives have only recently begun to be studied. In the meantime, the city continues to excavate a new two-acre area in federally protected city park-

"Solid and liquid waste management remains an issue that local municipal officials have successfully ignored but which is nearing a critical level."

land on the island to obtain cover material for this landfill.

The dump on Long Island sits above the underground water recharge area that is the source of well water for a large part of the island. No polluted wells have been reported yet, but the potential for serious problems remains. Cliff Island, the smallest in population and the most rural of the Portland islands, has no public trash disposal. Traditionally, Cliff Islanders have burned what is burnable and dumped the balance overboard. Because the city claims it is too expensive to pick up this trash, this practice continues. According to city officials, the equivalent of six truckloads a week is being dumped into the bay during the summer months.

The Casco Bay Islands, a subset of small communities in the northeast region, represent a unique case for study because their boundaries are clearly defined. Focusing attention on these communities can provide a forecast of solid and liquid waste issues that also affect mainland communities. They can also provide object lessons in the tradeoffs between environmental issues and pressure for development.

Maine Rural Islands

Maine has a relationship to the U.S. similar to that of an underdeveloped country. It relies on the rest of New England in many ways, including the tourists who enliven the coast during the summer. Thus, "sustainability" is a valuable goal for this mature region.

Economy

A map reveals key features of the region which play a role in the economy. Three big industrial rivers – Androscoggin, Kennebec and Penobscot – have been cleaned up to Class B in the last five years, and they have a large hydro potential. Second is the route of the Maine Central, which ends at Rockland. Third are the deep water ports: Portland, Rockland, Searsport, and Eastport.

Maine is still a manufacturing state, and most of the inland communities are located at river falls. The largest dams are still in use, and water power is an important element in Maine's future. Despite the vast acreages of forest, resource-based industry is a relatively small element in Maine's economy. Service industries, as in every part of the U.S., are growing rapidly.

Farmland has declined to one-third of its peak in 1950; similar trends are seen in the rest of New England and the United States. Maine's personal farm income shows fluctuations related to the potato crop and to the loss of the chicken industry around Belfast in 1979, when the three largest producers went out of business – their myopic management unable to adjust to rising energy prices. The egg industry, on the other hand, is stable. Fruits and berries, some of them organically grown, are important crops and contribute to the coastal town renaissance.

Philip Conkling

February 15, 1984

Philip Conkling directs the Island Institute, formed in 1983 to study sustainability issues of the Maine islands. Conkling has also been a Staff Naturalist for the Hurricane Island Outward Bound School since 1977. As an environmental consultant, he has prepared reports for the Maine State Planning Office, the U.S. Forest Service, and the Bureau of Public Lands. He has an M.S. in Natural Resource Management from Yale and an A.B. in Political Science from Harvard.

Tourism is not a major industry, but statistics are difficult to obtain because the U.S. Census Bureau does not recognize tourism as a standard employment category. According to State Planning Office sources, tourism ranks 7th in terms of employment, while it ranks 12th in terms of proprietors' and labor income. However, tourism is rapidly growing. Between 1970 and 1980, labor and proprietors' income rose 46% in real dollars. Employment in the tourist industry increased by 87% during the same period. By another measure, the total number of seasonal homes occupied by residents from other states increased by 20%. Acadia National Park, with 4.2 million visitors a year, is the second most visited national park in the country. Eagle Island, owned by the state, has 25,000 visitors a year. In the past six years the schooner fleet carrying tourists to islands has grown from 10 to 30 boats. These trends portend significant changes in the social and economic character of Maine island communities.

The fisheries industry recuperated from its 1972 low after the "200 mile limit" was passed in 1976. Little fish processing is done in Maine, but *18%* of the *world's* fish catch comes from the Gulf of Maine.

Maine is a net importer of goods, with 78% arriving by truck, 21% by rail, and 1% by sea. Water ports are crucial, however. Thirty-five percent of Maine's exports are sold in New England; 18% of its imports come from New England.

Energy

In terms of energy, Maine has one nuclear power plant, with no more planned. There is

"Maine has a relationship to the U.S. similar to that of an underdeveloped country."

great potential for wood and coal usage to increase in tandem with a great drop in oil use. Some institutions are beginning to use wood chips for fuel. Fifty percent of homes are now heated at least partially by wood. One hundred megawatts of hydro are planned for the next five years, with 180 more available but not likely to be developed, as the calculated avoided cost for new hydro is 9 cents/kWh. Coal, on the other hand, can be shipped cheaply to Searsport by ship and then distributed by rail. (However, Thomaston Cement Plant, St. Regis Paper, and Great Northern Paper all began to convert to coal, and then backed off when oil became cheaper.)

"... 18% of the world's fish catch comes from the Gulf of Maine."

Demography

Demographically, there is a significant "greening" underway. Young, well-educated immigrants with small families are moving into professional and managerial jobs. Most immigration is to the coastal region. Many parts of old milltowns and seaports are being gentrified. In general, however, Maine income is still below the U.S. average, so the quality of life is a crucial issue. The result of these demographic trends is the development of two cultures in Maine: one in the vast Appalachian upland, and the other in the southern coastal fringe.

"Fishermen and Indians used the islands before the year 1500."

What might be called "mid-tech" employment is growing in York and Cumberland Counties, using cheap assembly labor. There may be real high-tech growth in the southwest counties in the next few years in part because the deregulation of airline travel is opening up Portland and connecting it more closely with the rest of the U.S.

"... settlers on the islands lived on a central island and used outlying ones as pastures."

"The year 1900 saw the peak, with every island over 10 acres in use. By 1920, only fishermen used them."

History (Slide Commentary)

There are 3000 islands in Maine – 1700 of them forested, 25 with year-round inhabitants, and 300 to 400 more with seasonal residences. Islands constitute 250,000 acres.

Fishermen and Indians used the islands before the year 1500. Seafaring fishermen set up drying yards, and then established the first year-round community in New England on Damariscotta Island in 1605.

The French and Indian Wars of 1670 to 1760 were fought over Maine resources: the English wanted the mast trees, and the French the furs that provided a source of cash exchange. All white settlements in Maine were burned at least twice during the war and thus white settlers moved to Monhegan and other islands. After the war, land hunger led to a tripling of the population in 30 years.

Water was the highway. Typically, settlers on the islands lived on a central island and used outlying ones as pastures. Boston provided a market for their wool and hay in the 1720's. The slaked lime industry relied upon burning spruce cordwood, and because the forests on the islands were dense stands of pure spruce, some islands were cut over by 1790.

Granite became another important industry. Naturally weathered into wide sheets with rectangular joints, it was easily quarried into large slabs. Hurricane Island was known for its quarries, 33 in number. The replacement of granite with Portland cement concrete, plus depletion of the soil, eventually caused the islands to lose population. The year 1900 saw the peak, with every island over 10 acres in use. By 1920, only fishermen used them.

In the 20th century, fishermen built fish traps, using rising tides to catch herring in spiral weirs. One reason the islands were settled early is that people could fish there without a boat.

Now there is a beautiful landscape on most of the islands. The islands are dotted with lovely lighthouses, which will be destroyed if not preserved and/or reused.

Tourism affects islands uniquely. People enjoy visiting them for camping and picnicking, and 30 of them are now served by schooners.

The "summer house" is a key issue, as people buy islands and become absentee owners for most of the year. This produces a conflict with the need for access to the islands by the lobster industry and clamdiggers.

A case study of 450-acre Allen Island, four miles from Port Clyde, shows that development can improve the islands' economy. Until 1920, there were seven families on Allen Island. Then it was owned by speculators and unoccupied for 50 years. New owners clear-cut 40 acres at the northern end of the island, and sold the birch to Monhegan island (6 miles out) for firewood. A sawmill was set up and a structure built on the island for the owners. The initial damage from the bulldozing looked severe, but in one year it had grown back beautifully. This demonstrates a potential island resource, now unmanaged, for needy islands.

A post and beam cape house shows good usage of native lumber. The pasture is managed by hardy sheep which keep the regrowth down. The added open space is useful for the growing island population, and helps keep the unique and varied landscape intact.

"Migration, rather than growth in place, is a major cause for population change. Aroostook County is losing population at the rate of a thousand per year because potatoes are not being sold."

Maine Resources and Economy

Dick Sherwood

March 7, 1984

Dick Sherwood is a sociologist and Senior Planner at the Maine State Planning Office. He talked about two projects: an analysis of the state based on a division into social areas; and a computer model of the state's economy that simulated the state's response to socioeconomic forces. Sherwood noted that the figures given below are approximate.

Social Area Analysis

Maine appears to be rural: 90% of its communities have fewer than 2,500 people; 50% fewer than 800. Though it is roughly 50/50 rural and urban, using U.S. standards, in fact it is best characterized as an urban labor force living in rural areas.

While state population has risen 13% over the last decade, suburban areas have grown 38%. This suburban development has occurred largely along roads connecting major centers. These are mainly blue collar areas (professional and technical people tend to live in the cities), and families are relatively large. Land is cheaper and taxes lower, and low-interest FMA loans are available. Added transportation costs do not seem important enough to overbalance these advantages. Another factor may be operating: New Englanders' historical desire to live apart. Only during the Indian wars were people forced to live together in towns; as soon as the wars were over, people dispersed back into the country.

This spread-out living pattern will inhibit some innovations such as deriving energy from waste, since it would be expensive to collect enough waste to run a plant. Another consequence of dispersed settlement is that 60% of households rely upon groundwater, and probably the same 60% use on-site waste disposal, resulting in extensive pollution of water supplies.

Migration, rather than growth in place, is a major cause for population change. Aroostook County is losing population at the rate of a thousand per year because potatoes are not being sold. The northern counties as a whole are holding even, due to in-migration. More than half the overall 13% rise in population occurred below Damariscotta and Waldoboro.

Some major trends seen on a map that highlighted socio-economic communities were: 1) a growth of rural poverty; 2) the stretching out of suburban development between cities; 3) the growth of sub-centers on the outskirts of larger ones; 4) relatively prosperous fishing centers scattered along the coast; and 5) 45% of the state land unincorporated and controlled by seven large timber companies.

New businesses have almost entirely been set up by in-migrants. These ventures tend to have a high value-to-weight ratio – businesses like cat litter, tennis racquets, news clipping services, etc. Thus, a number of these businesses rely on mail-order customers.

Computer Analyses

One-half of Maine's income is derived from the economy of the rest of the U.S. and the world. It consists of exports (paper, clothing, insurance services); tourism; government expenditures in Maine; etc. Over one-third of the economy is internal demand created by its one million people. About 14% consists of inter-industry exchanges such as chemicals used in the paper mills.

Maine gets a good return on its federal tax dollar: $1.29.

Below are some general trends in the half of the economy controlled by outside forces. Percentages shown are of the total state employment:

Trade and services – tourism	4
Trade and services – remainder	13
Natural resources (wood, paper, agriculture, fish, etc.)	12
Shoes and textiles	10.5
Metals and electronics	7.5
Other manufacturing	2.5
Federal construction and community development	2
Total (actual is 49%)	51.5

(Figures do not add up to the actual 49% because comparisons are being made across data sources, exact percentages of which vary slightly.)

Total employment percentages (for both halves of the economy combined) break down like this:

Trade and services – retail trade	30
Trade and services – business services	3
Trade and services – professional services	10
Trade and services – other	17
Natural resources	13
Construction	10
Clothing	7
Metals and electronics	6
Other (or error in rounding)	4

"The island is not dominated by retirees and summer people, as are many islands; people make a living there."

"A typical immigration pattern is that of a family from Boston or Hartford that acquires a summer house, winterizes it, and later moves up."

"...there is a high potential for fuel switching..."

Note that "trade and services" is a much smaller percentage of employment controlled by outside forces than it is of the total.

Using a computer model to project growth puts one heavily in debt to the input data. The state uses *Data Resources Inc.* projections for the nation, and makes the important assumption that no segment of Maine's industry will make major changes in the way it does business. Some of these "no change" assumptions are prudent to maintain: for instance, Aroostook county farmers are not about to aggregate their holdings into more efficient and profitable larger farms. However, the timber companies might improve their management practices, if forced, and the state might start heavy tourist advertising in excess of the mere $100,000 it now spends. With these caveats, we note that the state's own projections show virtually no growth in the "natural resource industries" (35% paper, 30% wood and 25% agriculture, plus miscellaneous elements). "Trade and services" is shown to grow about 20%, versus 35% if based entirely on the DRI data. Finally, "metals and electronics" will see 16% growth.

Population and employment growth from 1980 to 1990 is expected to be much like 1970-1980 – approximately 13%. The following figures show the expected proportions of that growth, for the three major areas of Maine:

Northern counties:
population 8%, employment 4%
Middle counties:
population 39%, employment 33%
Southern counties:
population 52%, employment 59%

Vinalhaven
Prospects are good. The island is not dominated by retirees and summer people, as are many islands; people make a living there. Fishing is strong, largely because of the 200 mile limit. One fisherman made over $1,000,000 last year; several made well over $250,000. There is a state bond issue to build fish piers on Vinalhaven and elsewhere. A state survey is underway to support a grant application for a fish-processing plant.

Peaks
Peaks Island is in Portland's suburban commuter zone. A typical immigration pattern is that of a family from Boston or Hartford that acquires a summer house, winterizes it, and later moves up. Any work done on Peaks must consider the Portland bureaucracy, which has not been enlightened in the past.

Politics
In 1975 and 1976, the "Commission on Maine's Future" was formed with 40 members. They could not agree on guidelines and accomplished little. However, a clean river bill has been passed, forcing the timber companies (who couldn't threaten to move,) to spend $500 million cleaning up their operations to help make the rivers swimmable. Although at the time they objected fiercely, they ended up better off because they became more energy efficient.

The state always has a problem in allocating funds. Do they try to hold the line in a region suffering ex-migration and poverty, or do they spend money in areas with the best growth potential? The state has established Community Development Offices in all regions.

The state also faces a problem of keeping the metals and electronics industry growing. This industry requires employees with a high level of skill (the relative percentages of high/moderate/low skill in that industry and in all employment are 48/45/6 versus 35/38/27). Although Maine has a high proportion of people finishing high school, only 40% of the high school graduates go to college. The result is that professional and technical jobs are often taken by in-migrants to the state.

Maine is in a good position with respect to energy. Although it is still 75% dependent upon imported oil, there is a high potential for fuel switching – already underway with a conservation trend and increased use of wood fuels.

Cogeneration is possible for many industries. There are prime hydro sites in the state, although there is also a lot of opposition to using them on environmental grounds. The energy position of Maine will improve further if gas prices rise. A gas pipeline is proposed through Maine to Nova Scotia; if it is built, Maine would be able to use some of the gas.

Improved timber management may not be possible, as more wood than can be used is now being produced. The 40-year cycle of fire and timber budworm, started in 1913, causes much timber die-off. In order to control the budworm cycle, junkwood should be pruned and forests replanted so that all trees are not the same age. Unfortunately, harvesting this waste wood would glut the market. Maine has no direct control over forest management, but does exert some regulation through the Land Use Regulation Commission, which acts like a zoning board for the unincorporated areas.

"Population in Maine is so low that the whole state is 'linked', a bit like a large extended family."

Development is using up much of the good farmland. Outsiders are buying farms, and unlike previous farmer-owners, they are not leasing grazing land to farmers.

Some miscellaneous facts:

College students tend to live along the I-95 corridor from Kittery to Bangor.

There are "micropolitan centers" growing up around the Route 95 exits.

Population in Maine is so low that the whole state is "linked," a bit like a large entended family.

75,000 more people moved into Maine than moved out in 1970-1980.

Changing the assumptions behind the computer model will, in Sherwood's opinion, merely change the distribution of employment in Maine, and will not increase the overall quantity.

Vinalhaven and Peaks Island are the last two places an agriculturist would choose to grow food. The growing season is short; the humus is thin (½"); it is foggy and cloudy; the air is salty; and it is rocky. The available soil is sandy, gravely, and porous, creating a fertility problem.

These islands are microcosms of the United States and New England. In order to survive, New England will have to use more of its urban and rural marginal land. Important considerations are what the islands can produce for themselves and what trade surplus they can export to the mainland.

Crisis in U.S. Agriculture
We have built our country on the strength of our agriculture systems, which allow us to spend less per capita on food than almost any other country and still provide much of the world's surplus. We export $40 billion and import $14 billion of food. This has been possible because of fertile land, good climate, fossil fuels, science and technology, and lots of hard-working people. Now, however, we're facing three catastrophes:

Physical catastrophe. Our natural soil resources are being depleted by erosion, a drop in soil fertility, a drop in phosphates, a rise in salinity, and increased alkalinity. An increase in irrigation to 25% of our cropland has magnified these problems. Also, a great deal of prime farmland is being converted to non-farm uses.

Bio-ecological catastrophe. The number of genetic varieties used has greatly diminished, narrowing the genetic resources available to cope with change. For instance, the government now tells farmers which of six standard types of corn to grow. Recently, a blight killed 15% of the crop, because of this lack of diversity. There were 1700 varieties of fruit and nut trees when the settlers came; we now have about 150. Natural systems of pest control by predators have been interrupted by pesticides and herbicides and by killing key animals. (Killing snakes, for instance, allowed the population of rodents to increase.) We now use 12 times the pesticides we did in 1950, but have *doubled* the crop losses. The chemicals we use contaminate water and soil. Further, our energy use in growing plants is enormous. Artificially synthesized hydroponic solutions like that demonstrated at the Kraft Foods Pavilion at Epcot Center can require the use of *50 calories* of energy to produce *1 calorie* of food! Other hydroponic approaches may be far more energy-efficient.

Cultural catastrophe. First, the number of small farmers, those closest to the ecosystem, is greatly reduced. Most farmers are now businessmen who "process" the land. Second, the local marketing and distribution network has been disrupted. Long distance food supply systems require 12 to 15 calories of energy per calorie of food to pack and distribute it.

New Englanders are somewhat more locally-oriented than the rest of the country. We *used* to produce food in our 150-day growing period. In the 1880's, New Hampshire produced the equivalent of a loaf of bread each week for every person in New England, on less bottom land than is still available in New Hampshire. However, to use more locally grown food we would need to change our tastes and eat more seasonal food, more pickled or frozen foods, and more canned or root-cellared food. We need to stop

Gary Hirshberg is presently director of the Rural Education Center in Wilton, New Hampshire, and is involved in the "China 2000" project. Previously, he was executive director of the New Alchemy Institute. He is the Founding President of the Cape and Islands Self-Reliance Corporation, the goal of which is a sustainable future for Cape Cod. His undergraduate degree from Hampshire College is in Environmental Studies, and he has done graduate work in climatology.

"We have built our country on the strength of our agriculture systems . . ."

"There were 1700 varieties of fruit and nut trees when the settlers came; we now have about 150."

". . . it takes 4,500 gallons of water in California to produce three meals for one person, and groundwater levels are dropping fast. Western states may soon be unable to export food."

growing corn to feed cows to make milk, and instead grow grains.

We in New England import 85% of our food and only have a two to three day food supply at any one time. We are very vulnerable to supply problems such as an oil shortage might cause. Oil also makes fertilizer, and the ratio of fertilizer use to food production has gone up eight times (according to the Cornucopia Project in *Empty Breadbasket).* Furthermore, it takes 4,500 gallons of water in California to produce three meals for one person, and groundwater levels are dropping fast. Western states may soon be unable to export food.

In addition, some 75% of our food is processed, triple the amount per capita in 1950. This processing is energy wasting and produces other side effects. For instance, the EDB contamination issue arose because most of the wheat used in processed food is two to three years old.

In short, we face enormous problems.

Factors Affecting Agricultural Viability

It's important for the Design-In to pay attention to what the islands need and can produce, rather than using them as artificial models for a bigger system. Each bioregion in New England is unique in its possibilities and requirements.

"Each bioregion in New England is unique in its possibilities and requirements."

It's useful to note factors determining whether a particular agricultural endeavor is viable:

The capability of the land. Even with greenhouses, you still need to pay attention to the soil's acidity and quality, the water supply, etc.

Access to needed resources. Choose plant varieties that thrive locally to supply essential nutrients, including protein.

Access to markets. Products for export must be sold through some kind of network. You may be faced with the irrationality of the system already in place. For instance, it is easier for Stonyfield Farm to ship yogurt from New Hampshire to another place in New Hampshire via Boston than it is to ship directly.

". . . it is easier for Stonyfield Farm to ship yogurt from New Hampshire to another place in New Hampshire via Boston than it is to ship directly."

Concentration of farmers. Farmers can join together to share trucking costs and farm machinery – in general, efficiency should be improved.

Source of capital. To convert land from non-agricultural to agricultural use, one requires investment, tax incentives, sources of capital, and willing assistance from investors and governments.

Managerial expertise. There is no abundance of ecologically-oriented agricultural greenhouse managers. There are only five or six experts in hydroponics in the northeast. We need experts in biological pest control and other areas as well.

Steve Taylor, Commissioner of Agriculture for the State of New Hampshire, compares these vital areas of agriculture to a three-legged stool:

Technology and managerial expertise.

Land. The high rate of farmland conversion into nonfarm uses is a matter of serious concern.

Marketing and distribution. There are real problems, but there are signs of hope, such as an increase in farmers' markets. Consumers are showing a preference for locally and regionally produced foods.

Island Production Possibilities

When we look at an island, we need to ask whether it can produce for a remote market (for example, Peaks producing for Portland), or whether changes can be made in the consumption patterns on the island. The latter would have a larger impact, and allow a better match between local production and local consumption.

– Micro-farming by individuals can be very productive. One-tenth of an acre can produce vegetables for ten people on Cape Cod. In China, one-third of an acre produces all the food needs for one person. Mushrooms and sprouts could be grown within the bunkers on Peaks Island for export to Portland.

– Greenhouse production is a good possibility. The Dutch have shown that big shelters can work, but a source of fertilizer is a key ingredient. Wastes from a nearby fish-processing plant could be used in a hydroponic system. (New Alchemy Institute has done a lot of research in this area.) Greenhouses can produce early and late crops for markets.

– "Tree cropping" (as one aspect of "permaculture") uses nature's way of creating a perennial agriculture: windrows serve a triple purpose of food production, wind protection to cut erosion, and pest control. Timber grown on slopes prevents erosion. Deciduous trees, including fruit and nut trees mixed with the productive evergreens, attract predators of agricultural pests. Finally, sheep keep down nutrient-stealing grass between the trees. (The term "permaculture" was coined by Bill Mollison.)

– New England cannot support "large scale" agriculture (acres of grain) because it never has had much arable land, and it has even less now.

"Waste 'problems' (human sewage, fish wastes on Vinalhaven) can become 'opportunities' as fertilizers."

Nevertheless, the land is productive, partly because it has the winter to recover. Many things will grow, for example wild rice. It is not generally regarded as very productive; however, some disagree, and suggest returning to native grains.

– Technology does exist for storing food over the winter without electric refrigeration: pickling, solar drying (which works even in cloudy weather), root cellars, etc.

– Berries are an attractive idea, although the blueberry market is now monopolized by one company. Extra-quality organic blueberries might find a market, however.

– Waste "problems" (human sewage, fish wastes on Vinalhaven) can become "opportunities" as fertilizers.

A crisis is coming rather soon – perhaps in 10 years – with the west no longer able to feed the whole country. We should work *now*, cooperatively, to develop the missing marketing and distribution network.

Waste Disposal and Recovery

Ron Zweig

As a "resource wealthy" culture, we throw away valuable resources and nutrients because that is the cheapest thing to do. This creates a spiraling need for resources such as energy. Our brief period of cheap oil, a mere blip in the curve of history, has transformed the whole planet and caused much damage to the environment.

For the first time in history, we have introduced a material into the environment which no one wants: nuclear wastes and fuel. Nearly everything else on the planet is processed by some living thing, and one being's waste is another's food or shelter. By contrast, nuclear wastes are toxic to every living thing.

We have much to learn from China. If the Chinese did not recycle wastes, they could not survive. Over many centuries, a system has evolved that utilizes most of the byproducts of civilization. Studying such a system focuses attention on the need for this kind of responsibility in our own society.

Throughout nature, the interfaces between ecosystems are the most productive areas. Marshes, river edges, and pond margins all tend to have more kinds of life and a higher rate of biomass growth. In such rich ecosystems, one process uses the wastes of another. So it is in China. Around its cities are rural areas in which large-acreage crops like grains are grown. At the interface between city and country are intense agricultural areas in which vegetables, livestock, and fish are produced for urban consumption. Such a pattern reduces transportation cost and reduces the need for refrigeration. Wastes from the city are used for nutrients. This pattern works even for some of the world's largest cities, such as Shanghai.

China has not had our level of technological development, and so has been able to retain its urban/rural pattern. Our problem, then, is to use our advanced scientific understanding to extract the principles from the Chinese system for use in our complex urban society.

Slides describing "China as a Development Model" showed a commune in China in which the principles of reuse were greatly extended. The system included the production of bio-gas, use of slurry residue for fertilizers, the use of human wastes, etc.

Details of various waste-recycling systems were discussed – in particular, the use of a solar greenhouse system for secondary processing of sewage. The basic concept is to create a pond, either still or slowly moving, filled with sewage effluent and covered with some kind of glazing. In the pond grow water hyacinths, the aggressive plants which clog waterways all over the southeastern U.S. These plants remove most of the nutrients from the sewage; then they themselves are used to add bulk to sewage sludge, to create methane, and to provide fertilizer.

What happens to the effluent? This depends on the quality of the fluid. If it has been run through an ozonator, or (at more energy expense) through a reverse osmosis process, it can be used to recharge an aquifer. If not, it might be used to water trees; the pathogens are removed during its passage through the soil before reaching the aquifer.

The sludge can be used for fertilizer, with proper precautions, as has been done with Milorganite. It is expensive to remove the toxic materials such as heavy metals and organic sol-

Ron Zweig directs Aquaculture programs at New Alchemy Institute. Recently he has worked with the water quality advisory committee of the town of Yarmouth, Massachusetts on a proposal for a new sewage treatment plant which would purify septage from on-site systems. He has also worked in the People's Republic of China.

"For the first time in history, we have introduced a material into the environment which no one wants: nuclear wastes and fuel."

"Our problem, then, is to use our advanced scientific understanding to extract the principles from the Chinese system for use in our complex urban society."

vents, and so this fertilizer must not be used for edible plants.

Gas created as a byproduct of primary sewage treatment can be used for energy, often within the plant.

Several systems of this sort have been constructed, including one at Yarmouth on Cape Cod. In that design, a lean-to building 32 feet wide (from north to south) is built alongside a 250 foot sewage treatment building. The plant uses septage from septic tanks and not sewage. The plant works on the average 120 days a year; the rest of the time it is too cold, and the water hyacinths are dormant. It can process septage from about 300 homes each year, for a total of 900 homes (each home needs septage processing once in three years, and the pumping can be scheduled for times when the plant is working). So 300,000 gallons of septage run through the plant in 120 days, or about 2,500 gallons of septage each working day. The tank actually contains 25,000 gallons, since the septage is diluted. At the end of the process, the effluent is ozonated in a tank built under the greenhouse. This uses energy, but kills pathogens in the water.

A similar plant, the prototype for the Yarmouth plant, has been working successfully in San Diego. That city is about to build a million gallon facility.

What happens when you connect a plant like this with a sewage system? The key issue is that sewage flows all the time, while the plants only work on occasion. In communities with seasonal peaks in population during the summer, the flow rate and the processing rate are closely linked. The ratio of summer to winter people must be high, such as the 4 to 1 ratio in Falmouth. For temporary overloads, you need a storage lagoon. The system must be sized for the winter condition, or some means devised to switch systems in winter.

Gordon Tully added some calculations and commentary. One question was: what will limit production in the proposed plant? There are two elements common to any greenhouse. First, the plants need light and sun to grow and process the sewage. Second, the plants must be warm enough to grow. During the winter, there is less sun and less heat. In Portland, on a vertical surface, the sunlight on an average day varies from about 600 BTU/square foot in December to about 900 to 1000 BTU/square foot from March through October. On a horizontal surface, it varies from about 400 in December through 1700 in June. (The vertical surface is assumed to face south. Off-south orientations make little difference, except for one crucial issue: the sun will be lower in the sky on off-south glazing, and surrounding trees will have a much greater impact.) Typical greenhouses have tilted glazing, with input values ranging from about 500 in winter to 1200 in spring and fall, dropping off slightly in summer. So, as a rule of thumb, sunlight varies by a factor of two to two-and-a-half between summer and winter. Average ambient temperature in Portland varies from 22°F in January to 68°F in July.

Combining these factors and evaluating costs and benefits supports the current design practice: it is not worthwhile to invest in sophisticated and expensive glazing systems; instead, one should concentrate on using the plant in the summer. If continuous throughput is desired, then one must design for the winter condition.

Tully noted that it is not clear exactly where the tradeoff must be made in glazing investment. With regard to geometry, he suspects that the more important the winter-time condition is, the more careful one must be about optimizing the glazing in a single, south-facing tilted surface. A dome, for example, would not be appropriate; it would add heat loss out of proportion to sunlight gain.

Zweig noted that trying to deal with sewage (or septage) on a rock in the ocean is perhaps the ultimate challenge, and there is no inexpensive solution. Even using sophisticated waste treatment, there is a lack of soil with which to treat the effluent by filtration. Even if "Clivus Multrum" toilets (or smaller units requiring a small amount of electicity) are used, you still must deal with grey water from washing. We may need to invest in expensive reverse osmosis for final treatment.

For work on an island, local knowledge is vital. We must ask our questions of a local civil engineer who is familiar with the geology of the island.

Water conservation is a good idea on an island, but may create secondary problems in dealing with waste. For example, a sewer needs sufficient water to work. We might use an imaginative combination of conservation, central treatment of grey water, and special disposal measures during the winter.

"...trying to deal with sewage (or septage) on a rock in the ocean is perhaps the ultimate challenge..."

Leslie Horst

Leslie Horst

V The Design-In

Held at the Fifth Maine Regiment Community Center, Peaks Island, May 31 to June 2, 1984

The Weekend

Leslie Horst

On May 31, 1984, and for most of the succeeding weekend, the weather on Peaks Island was rainy, windy, and bone-chilling – winter's last reminder that the climate of coastal northern New England can be harsh. Nonetheless, over 30 participants in the Design-In boarded the ferry and came to the Fifth Maine Regiment Community Center for all or part of the weekend.

We began on Thursday evening with a buffet-style supper. After supper we were welcomed by Sally Harkness, who also announced the composition of the two design teams (one for Peaks Island, one for Vinalhaven). Each of us also introduced her or himself and indicated our particular interests and expertise.

After these introductions, we were welcomed to Peaks Island by Irene Fitzgerald (chair of the local town meeting) and Peg Harmon (for the Fifth Maine Regiment Community Center). Their comments are summarized elsewhere in this report. Finally, John Crowley presented an overview of Peaks Island, and Philip Conkling and Dick Morehouse did the same for Vinalhaven.

On Friday morning, Tim Coppola presented some of the detailed materials (maps, etc.) which were made available to participants for their work. Weather notwithstanding, a number of people then took driving or walking tours of Peaks. It was so cold that we had to crank up the Fifth Maine's wheezy heating system (and call the oil burner repair people twice in order to keep it going), but by midmorning the two design teams were deeply involved in conceptualizing the design tasks which they faced.

During the lunch break, we heard a presentation by Alex Jaegerman, the Chief Planner for the city of Portland. His talk (summarized elsewhere in this report) provided a context in which the Peaks Island team could work.

For the rest of the afternoon the design teams continued working, until we broke for a true Maine clambake presented by the Lions Club of Peaks Island. The rest of the evening was unscheduled, but many discussions of the issues continued.

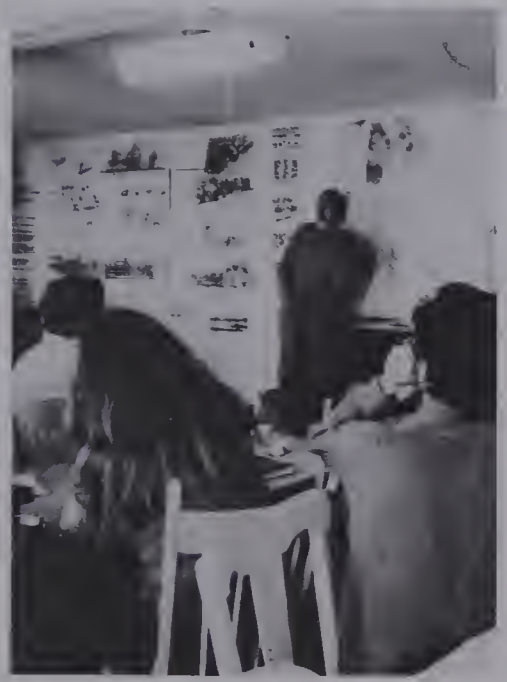
Most of Saturday (as the rains still came) was given over to design team work. One guest speaker, who was scheduled to talk to us during dinner, was forced to cancel his appearance due to the rapidly rising level of water in his basement.

Sunday morning brought some sunshine and the completion of our work during the weekend. Each team gave a comprehensive presentation of both its deliberations and its design work, the results of which comprise the major section of this report. The (temporarily) fine weather also gave Dick Morehouse an opportunity to move outdoors and film interviews with a number of participants, as part of the documentation of the weekend.

By 2:00 p.m. most of the participants had left. Some of us almost had an extra night on Peaks, as the ferry ramp on the Portland side had begun malfunctioning – another reminder of the unpredictabilities of island life. We all took away with us a number of indelible impressions: the graciousness and helpfulness of our hosts; the care and skill of the people who provided meals and other services; and a sense of the special nature of island living which all of us want to help preserve, even as places like Peaks and Vinalhaven face a series of challenges in the years to come.

"Everyone will have to decide how they want the islands to be."

Irene is Chair of the Peaks Island Town Meeting Committee and is Vice President of Employee Benefit Services, Inc., a firm in Portland which provides individual and corporate retirement planning and administration.



Welcome from Irene Fitzgerald

Irene began by welcoming the group to Peaks Island. She stated that she would be speaking from the perspective of someone who had seen many changes in a comparatively short time of living on the island (13 years).

A first influx of people occurred as the old port area of Portland began to be redeveloped. Artisans and others began refurbishing buildings and using them for studios and residences. There was a "natural progression" by which some of these people wanted to combine the advantages of rural living with those which come from being near an urban center.

A second influx has been those who are colloquially called "Yuppies" – young urban professionals. As a result of both waves of people, a number of new institutions have been developed: a health center, a branch library, a community center, etc.

The single most outstanding example of community participation was the process by which a group of citizens succeeded in purchasing the commuter boat line out of bankruptcy court. The Casco Bay Island Development Association guaranteed payment of some of the legal fees involved, thus providing crucial backing at the right time. Now the commuter boats are owned by the residents of the Casco Bay Islands and run by the Casco Bay Island Transit District. For Irene, the significance of this development is that when enough people who need services get together, they can work successfully to bring those services about.

Irene also discussed several pressing concerns for island residents. Chief among these is that the island has to be able to absorb and sustain

Summary prepared by Leslie Horst

the need and desire for services while at the same time preserving the quality of life which is so special. Solid waste management and maintaining good water quality are two important aspects of this issue. It was appropriate that the islands have been separated from the rest of the city of Portland for the rezoning studies now underway. Islanders are very concerned both about the pressure for development and the possibility of a substantial increase in the number of cars. Residents will be participating actively in the deliberations of the Council of Governments, which has been contracted by the city to make zoning recommendations for the islands.

The Fifth Maine Regiment Community Center Peg Harmon

In November, 1887, a corporation called the Fifth Maine Memorial Society was formed in memory of the Fifth Maine Regiment Volunteer Infantry men who were killed in battle or had since died of wounds or disease. Members of the Society then began work on a building in which to hold annual reunions. The land for the Fifth Maine Regiment Community Center on Peaks Island was deeded to the men of the Fifth Maine Regiment of the Civil War by Anna B. Goodson of Buxton, Maine, and George E. Beason of Portland.

When it was first built, the building faced the water, with the stairs leading to the ground from the door (there was no porch then). The main hall was named "Memorial Hall" and still holds that name. The beautiful stained glass windows are in memory of the veterans.

A few years later the porch was added on all four sides. The dining room and kitchen were built during the summers of 1898 and 1899. Water was piped to the kitchen only; a row of outhouses extended beyond the kitchen near the beach.

Since the original plan was to hold reunions for men only, the second floor was made as an open dormitory. Eventually it was divided into small rooms to accomodate vacationing families of veterans for a week at a time. The waiting list was long.

The building was open for the summer only and was managed by the family of a veteran (as the rules required). Yearly reunions were held until 1925 and family members continued to vacation until 1947. By then, no one cared to manage the building, and it was in a sad, deteriorated state. The doors were closed from 1947 to 1955, at which time the descendents turned it over to the people of Peaks Island for use as a community center.

So far we have spent over $100,000 on restoring and renovating the building, but it needs much more. We earn money by putting on suppers and renting the building for social functions. Our membership is now about 150 and dues are $5 yearly; we welcome new members.

There are many relics and souvenirs on display. Some were brought back from war areas by soldiers, and others have been donated. Many items are still in storage.

If the building cannot be properly maintained, it is to be razed, and a park to be known as Fifth Maine Memorial Park is to be built for islanders' use. The large boulder on the front lawn must remain where it is or in an equally fitting spot.

Each year we advertise for a curator (or curators) to keep the building open daily for visiting. This is the fifth year we have done this and we feel most fortunate for the response and interest we have had. Although we have winterized most of the building, it is open to visitors only in the summer months.

We are now listed in the National Register of Historic Buildings and Structures in Washington, D.C., and have received a plaque which states that fact.

Leslie Horst

"Movement toward more self-sustaining capacity might also imply a higher rate of development (to generate tax revenues) or, more likely, a very limited development pace (to keep service costs down)."

Bernie LaCasse

Planning and the Casco Bay Islands

The City of Portland is actively engaged in an ongoing, comprehensive rezoning process, proceeding from land use sector to land use sector. Waterfront zoning was addressed first. There, the goal was to achieve a balance between flexible mixed-use vs. more specialized fishing and marine industrial use. There is a risk of the latter's being pushed out by the former unless certain areas are set aside.

The residential sector, encompassing the whole city and the islands, was considered next. It became clear that the islands needed separate treatment and further research. In order for the work to be done in a timely way, and to have open discussion occur in summer (when both year-round and seasonal residents would be available), the city contracted with the Council of Governments to do the study on the islands. COG had the appropriate expertise, having already done some studies of solid waste and water management, and the city planners are working closely with them. The outcome of the work will be a proposed new text for zoning.

All sorts of building proposals – a conference center, elderly housing, high-density housing, a corporate retreat, and so on, have been made for one or another of the islands. A re-use study of Fort Gorges (which one sees on the way to Peaks) will be done as part of a separate study. There was a proposal a few years ago to turn it into a restaurant. These proposals are indicative of the kinds of land use and development pressures affecting island properties.

There are unique constraints brought about by the island setting. The infrastructure is limited, and expensive to improve. Some people on the islands have city water, but others do not, and

Presentation by Alex Jaegerman

groundwater is limited. Study of the aquifers is needed.

At the same time, it is important to recognize that some of the limitations of infrastructure could be overcome if enough money were spent (e.g., a waste treatment plant could be built, expensive solid waste contracts could be signed, etc.). The implication of this is that nobody should rely on apparent infrastructure and economic limitations to prevent undesirable changes in land use; zoning should be the determining factor. At this point, the City of Portland does not have preconceived notions of what island development should be like. Everyone will have to decide how they want the islands to be.

In the 1970's the federal government said that secondary treatment was required before sewage could be discharged into the ocean. As is the case for many other islands on both coasts, Peaks discharges some of its sewage directly into the ocean. So there was a proposal to build a sewage treatment plant on Peaks as was done on the mainland. It was clear that both the cost and the increased carrying capacity could trigger substantial new development. The incentive would have been to increase development because of the economies of scale (more residents would be needed in order to pay users' fees so that the plant could be economically viable for the city). As a result, the idea of a treatment plant provoked substantial opposition. In fact, up to a reasonable point (and depending on how far out the outfall is piped), the ocean has a large capacity to absorb sewage without known harm. Communities on both coasts, including Portland for the Casco

Summary Prepared by Leslie Horst

Bay Islands, have applied for waivers from the requirement for secondary treatment. All these applications seem to be pending indefinitely at this point.

It is possible that in order to deal with solid waste an incinerator will have to be built on one of the islands and used by the other islands. The resulting increase in carrying capacity (and therefore in pressure toward development) would be affected by the size and type of incinerator which was built.

The rezoning study is being done under a spotlight of public scrutiny, which Jaegerman characterizes as "healthy." There are some well-publicized privately-held large parcels on Long Island and Great Diamond Island, the disposition of which would have an enormous impact on the lives of the people who live on those islands. The situation on Peaks differs from that of other islands because there are sizable areas of open space owned by the city and by the STAR Foundation. This assures a better chance of future public access to open space on Peaks than on the other islands. The islanders are active and involved in the rezoning process, at least in part because they don't necessarily trust the city to come up with decisions which will be satisfactory.

One way of considering "sustainability" is to ask questions about fiscal sustainability. It would hardly be realistic to expect the islands to be able to pay their own way, but at least the islands should be "affordable." These issues come up when, for instance, one observes the enormous share (relative to population) of the city's waste disposal budget which is consumed by the islands. Movement toward more self-sustaining capacity might also imply a higher rate of development (to generate tax revenues) or, more likely, a very limited development pace (to keep service costs down). Clearly, these questions need to be considered very carefully.

One participant asked whether Peaks (or other islands) could apply separately for federal community block grant money. The answer was no, but the islands as a whole are considered to be a target neighborhood for community development money. The Portland City Council allocates money throughout the city, including the islands.

Alex Jaegerman is the Chief Planner of the City of Portland.

"A distinct advantage for Vinalhaven is that water is plentiful."

Editors' Note: The choice of Vinalhaven came from a desire to compare two very different island settings, one urban and one rural. The Vinalhaven study was necessarily more hypothetical than realistic, for several reasons: first, the design team was not able to visit the island or to hear directly from the year-round residents; and second, the data to work from were more limited than was the case for Peaks Island. The recommendations given here address the subject of growth, should this take place in the future. Sustainability is considered in the light of social factors as related to ecology, rather than the other way around as in Peaks Island. A realistic study of sustainability on Vinalhaven should involve the island residents themselves from the very outset. In this case the recommendations might have been different.

Dick Morehouse

VI Vinalhaven: Design and Recommendations

Gordon Tully

Existing Conditions

Like many of the Maine islands, Vinalhaven has lost population since 1900. This has resulted from a switch from the use of granite to concrete in the building industry, depletion of the soil, and a general outmigration to more prosperous areas. The present permanent population is approximately 1100 persons, most of whom are in one way or another related to the fishing industry. There are another 3000 summer residents.

The permanent population lives almost entirely in the town of Vinalhaven, the terminus of the island ferry, located at the south shore of the island. Summer people, on the other hand, pepper the shore around the entire perimeter of the island. Those at the northern end really are part of North Haven; they seldom pass through the town, instead using the North Haven ferry after a short boat ride across the strait separating the two islands.

The island is formed primarily of granite, with areas of marshy lowlands stretching irregularly among the rises. The coastline is deeply indented with salt marshes at the head of most inlets and along much of the southern and eastern coastline. The land is useful for forests and blueberries, and parts (e.g. the northeast peninsula) could be cleared for pasture and farmland.

The rocky landscape creates problems for dense settlement. As our standards of sanitation rise, close spacing of septic systems becomes questionable on thin soil with poor percolation – the prevailing condition on the island. Drainage is critical in siting buildings; if water does not run off, it stands on the site or under buildings.

Balancing these problems are the advantages of very low density. Waste disposal, while a problem as it is in every community, is less serious than it would be if the island were densely populated. Unlike sewage, no one tries to dispose of waste on site. However, a properly controlled landfill can serve the island for the indefinite future.

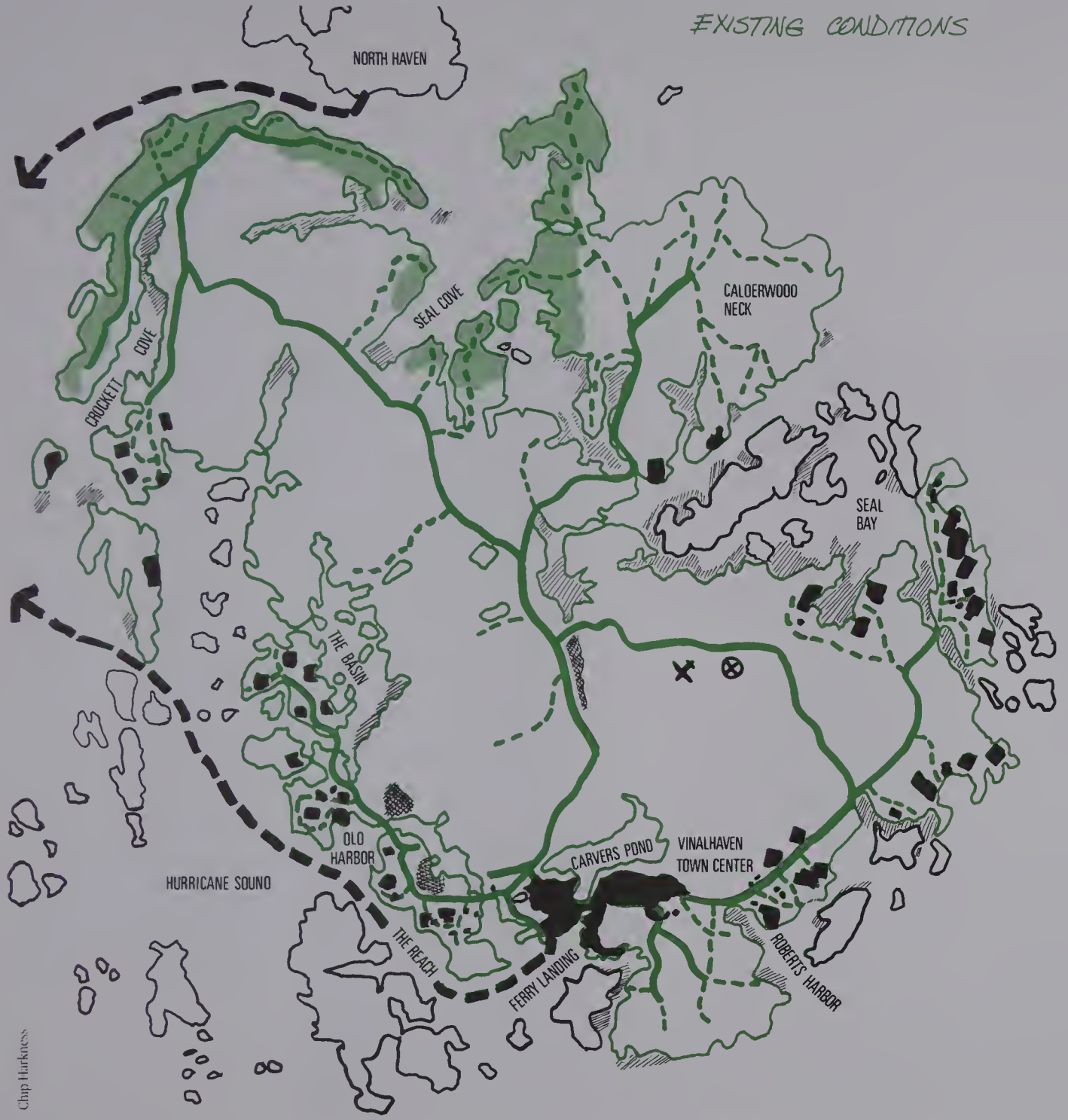
A distinct advantage for Vinalhaven is that water is plentiful. It must be noted, however, that sewage probably contaminates some of the existing water supplies, and that wells must be carefully located.

The island location also creates a mixture of problems and advantages. Living on an island is a special experience, one filled with romantic overtones. This is easily forgotten on a dreary day in January, which explains the small number of retirees and summer people who stay on throughout the year. It is difficult to get supplies to the island. The cost of everything not produced on the island is elevated by the cost of the 20 mile boat ride from the mainland. Some promising industry (as will be explored later) is unlikely to be developed due to the island location.

One commodity is of special interest to all islanders – energy. There is a working power cable to the island. Its size limits the amount of development possible on the island without adding expensive on-island generating equipment. Replacing the cable if it were damaged beyond repair would cost each resident $500 – not an impossible sum, but something to be reckoned with. Fuel must be shipped to the island, and only a small reserve is likely to be stored there. Nevertheless, the existence of a cable makes alternative energy sources such as solar or wind much less economically desirable than would be the case on a more remote island.

"... our perception of sustainability was social more than physical."

"We found records indicating that when the island community numbered 3,000 people or more, there was a much higher level of social gathering..."



The Key Elements in the Island's Future

Sustainability – the central focus of the design-in – remains a variable concept, suitable to any number of interpretations. Those who studied Vinalhaven chose to focus on problems which might, in the near future, cause the island's situation to change for the worse. "For the worse" was taken to mean in such a way as to upset the evident desire of the year-round residents to maintain a viable island community. "Viable," in turn, meant to us a reasonable standard of living, a lack of serious and general social pathology, and a situation good enough to keep young people on the island while attracting households of people who are a welcome addition to the community and who desire to stay. In short, our perception of sustainability was social more than physical.

This social emphasis was inspired by the general lack of serious environmental problems – sewage disposal being the most pressing – along with evidence that the stability of the community was seriously threatened by a number of factors. Most serious, in our view, was the difficulty of maintaining crucial social institutions with such a small population.

Good schools are very hard to create and maintain when there are very few students of any given age. Inter-family feuds can easily become major issues when there is very little choice among potential friends. It is almost impossible to create and maintain amenities like clubs, recreation facilities, artistic organizations, volunteer groups, etc., unless a critical number of people is available to carry the burden of holding meetings, keeping others informed, and raising funds.

Two observations had a large influence on our

deliberations. We found records indicating that when the island community numbered 3,000 people or more, there was a much higher level of social gathering (for dances, concerts, recreation and special events) than is now observed in the town. We also found sociological sources which suggest 3,000 persons is a reasonable minimum number to form a strong, active community.

Despite our strong emphasis on social issues, there are also a number of very useful changes regarding environmental issues which could be made. If these changes can be integrated into a creative social program, they will help focus community attention on improving the community. A gathering of the community around specific environmental issues which need attention at once unites the community, helps individuals understand that they can really change how they live, and improves the chances that needed changes really will be made. An essential element of sustainability is a renewal of local action and decision-making.

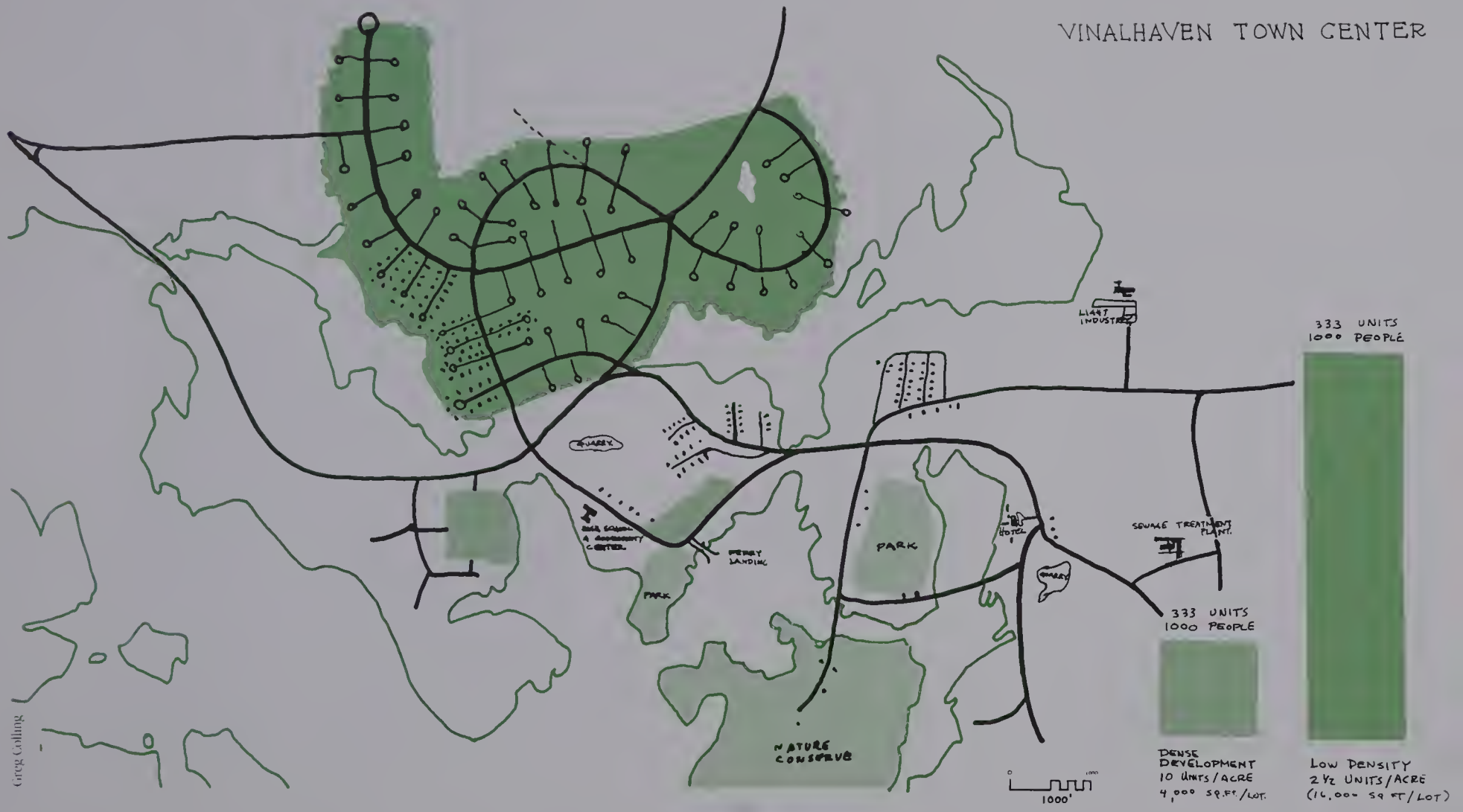
Based on these admittedly subjective ideas, we defined the changes needed to make the island's future more nearly sustainable and to improve the quality of community life and educational opportunity on the island:

Increase the year-round population from 1100 to about 3000.

Accommodate a natural increase in the seasonal population from 3000 to 4000 people.

Encourage a higher level of community self-reliance, especially with regard to food, energy, waste management and community

Chip Harkness



Greg Colling

reinvestment in both human and natural resources.

Make the well-being of the year-round residents the first priority in all planning.

Specific Planning Criteria

Certain overriding principles governed our planning effort, and led to the specific recommendations discussed in the next section.

Maintain the basic image and integrity of the town
Almost tripling the size of a village could be extremely destructive if not handled with sensitivity. The existing town has much charm, even while it is in need of many improvements. Even modest land-takings can split a community, and so existing ownership and structures must be respected.

Use multi-purpose zoning
One of the nice features of many New England towns, including Vinalhaven, is the intimate mixture of several land uses. This mixture is practical, because owners can have businesses in their homes, and can live close to the docks or workshops – something one can appreciate on a cold and windy winter day. The mix is also attractive – a major component of the appeal of New England towns.

Find in-town sites for urban additions, such as a school/community center/library, apartments, and a hotel

Maximize infill
Use of infill development to fill in the "missing teeth" in the town, could have several clear benefits. First, community services – roads, power, water, etc. – would be less expensive to provide. Second, walking distances to the center of town would be kept low. Third, the visual coherence of the Carver's Harbor area could be enhanced.

Avoid a "new town/old town" split
If all the additions to the town took place outside the existing center, a typical urban-suburban split would take place. "Good" new homes would be located in the outskirts, implying that the old homes in the center were "bad". The addition of community facilities and in-fill within the existing town boundaries can prevent this problem from developing.

"In a sustainable community, sewage can also be viewed as a resource which is largely wasted in traditional disposal methods."

"For nutrient recycling, a central lagoon storage facility with an aquaculture purification system could be used."

Specific Recommendations

Housing
Using a typical mix of housing unit sizes, a possible distribution of new housing is as follows: 500 new housing units in a mix of apartments, attached homes and detached homes (125 two bedroom units, 250 three bedroom units, 125 four bedroom units); 100 new two bedroom seasonal rental units, attached to existing structures; and 125 new seasonal residences, assuming 5 people each. This mix would accommodate 1900 new permanent residents, and 1000 new seasonal residents.

Community Infrastructure
Educational facilities are conceived to be part of two new multi-use facilities:

A new high school/community center/library, located near the center of town. This is a common pattern for villages, and would maximize the possibility of sharing expensive facilities like an auditorium and library.

A new vocational institution, associated with one of the light industries or boat-related industries. On-the-job training would be the focus of this facility, providing opportunities for young people who wish to stay on the island in a skilled worker capacity.

A larger town building is needed to house the fire station, police station and town offices; it should be located near the center of town. It would of course be a gathering place, and should be thought of as a social center as well as a functional element.

In addition to the new seasonal housing, tourist accommodations are needed for short-term business and pleasure visits:

A new 25 room hotel, to house up to 50 people, is an important element in the master plan.

The hotel would be supplemented by a **12 room guest house**, for up to 25 people (or possibly more than one smaller facility).

Apartments in town are mentioned under housing.

Roads would have to be improved where necessary to accommodate the increased population, and of course new roads would be needed in the areas of new development. No other new roads are contemplated.

Public transportation was considered adequate in principle, although with more residents, additional ferry trips would be likely. Taxi and jitney service might be justified year-round, given the proposed increase in population and industry, and considering the advantages of minimizing the use of vehicles on the island. However, personal car ownership is expected for convenience and for status, and semi-public modes of transport may prove acceptable only for seasonal residents.

The existing airport is assumed to remain in its present position. Extension of the runway is already being contemplated, and traffic will undoubtedly increase. The runway approach passes directly over the part of town where new development is suggested. In our view, traffic will never be bad enough to constitute a serious problem. Presumably, air traffic would be an infrequent diversion instead of a nuisance, and flights during sleeping hours could be prohibited.

Sewage Disposal
The basic goal of proper sewage disposal is the elimination of health and environmental hazards; sewage disposal is usually considered an expensive, if necessary, nuisance. In a sustainable community, sewage can also be viewed as a resource which is largely wasted in traditional disposal methods. Thus a second goal in our proposal is the maximum recycling of useful nutrients from sewage.

There are several constraints on a possible sewage system for the island.

Cost: only if the advantages of a system or the dangers of all alternatives are clear will citizens pay the high cost of proper disposal and recycling.

Technology: sewage disposal is a complex technology, in which innovation is very slow. Many promising new ideas are not tried because of the inherent conservatism of small communities when it comes to public works expenditures. New discoveries are made yearly, but public standards of acceptable health keep rising as we learn of new hazards.

Geology: the underlying rock of the island poses the single most severe limit on possible solutions. In brief, on-site disposal is expensive, and if used, sets a low upper limit on the density of settlement.

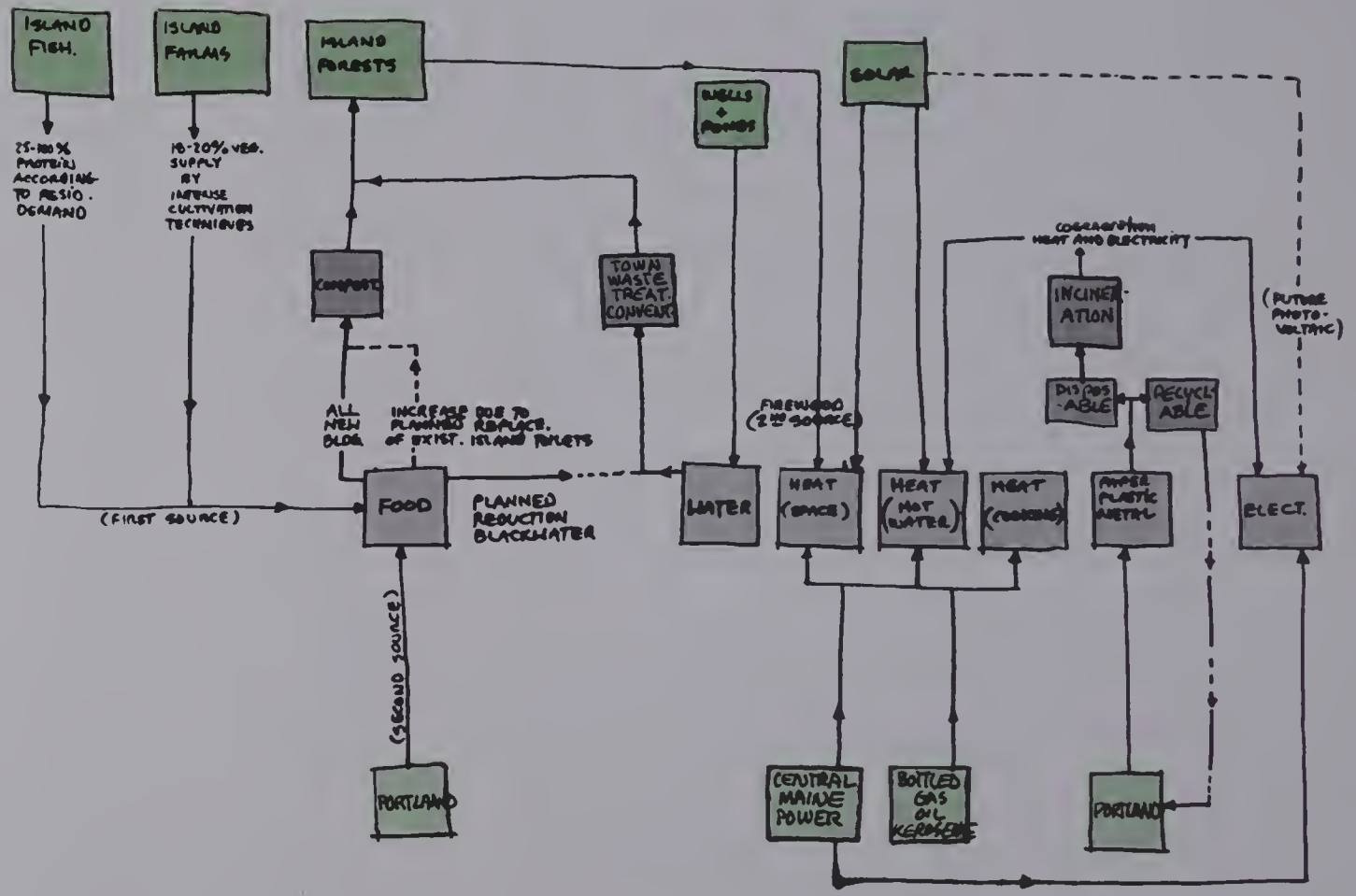
Aesthetics: some on-site disposal schemes, such as composting toilets, require compromises in the construction of dwellings, and in the visual character of the toilet, both of which are unacceptable to many Americans.

"Public education in the handling of toxic wastes is essential . . ."

ISLAND RESOURCES:

REQUIRED DEMAND:

OFF ISLAND RESOURCES:



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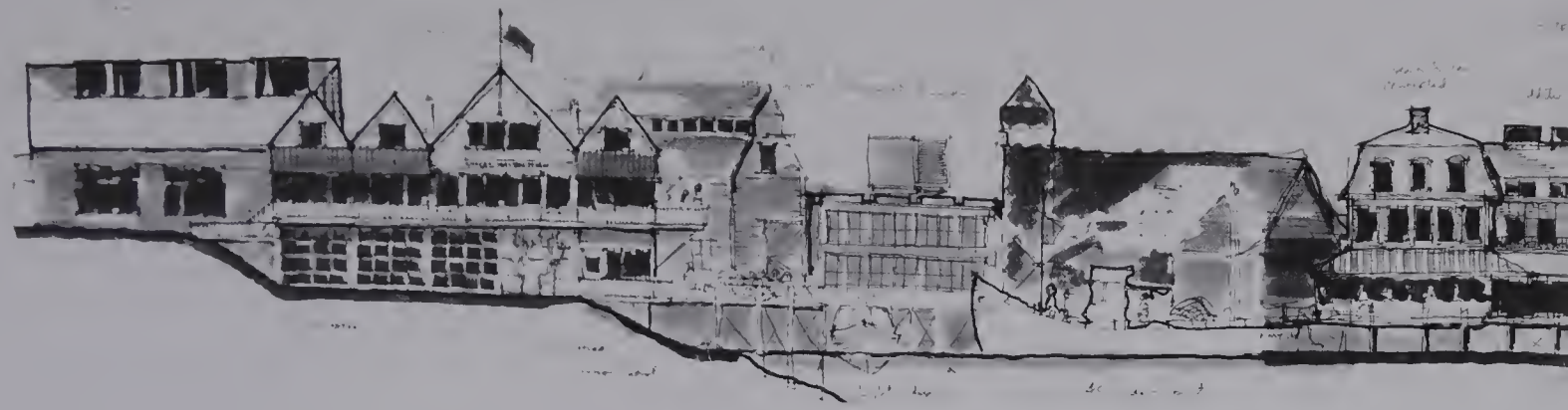

Option One:

1.
Add a conventional sewage system for the existing village, which is seriously in need of a proper disposal system.

2.
Introduce water-saving retrofits in older homes.

3.
All new housing, where possible, would use composting toilets. These would not be the "Clivus Multrum" type, but a more compact design using a small amount of electric heat.

4.
To gradually eliminate all conventional toilets, each resident would be given a toilet "medallion" (by analogy with taxi medallions or licenses) for each existing toilet. To build a new dwelling, a builder would have to purchase a medallion for each new toilet. Thus, money would be diverted from new construction to pay for the conversion of existing flush toilets to the composting variety.

5.
As old toilets are replaced, the conventional sewage system increasingly would handle only grey water. Upon completion of the changeover, the grey-water sewage could be returned to the land to provide nutrients.

6.
To protect the greywater system from toxic wastes, an education program would be initiated to encourage proper use of the sewage system.

7.
A sea outfall would be acceptable in lieu of land disposal, if nutrient recycling were not economically feasible.

Option Two:

1.
Provide a conventional sewage system throughout the town, including the new development areas.

2.
Require water conservation in the new housing, to minimize the load on the processing facility.

3.
Gradually introduce water conservation in existing housing.

4.
For nutrient recycling, a central lagoon storage facility with an aquaculture purification system could be used. A sea outfall is a possible alternative, and might be used in combination with an aquaculture system to handle overflow during the winter, when the plants do not grow, thus reducing the required size for the lagoon.

Solid Waste

Because of the low population density on the island, the existing solid waste facility is likely to prove adequate. Public education in the handling of toxic wastes is essential, and further study of alternatives for the long run is needed.

Water Supply

There are numerous well sites, aquifers, ponds and quarries to guarantee an adequate supply of water. Even so, an economical distribution system is not easy to develop. Piping, by and large, must run at or close to grade, and continuous flow must be guaranteed to prevent freezing. Water supply needs must be related to recreation demands, sewage disposal and other sources of toxicity, the reliability of the source, and the cost of the distribution system. Given the available information, we could not make specific recommendations concerning potential water sources.

Energy

It is convenient to think of energy problems in three categories: sources of electric energy and power; sources of fuel; and methods of avoiding the need for electric energy, electric power, and fuels.

Sources of Electric Energy and Power

As mentioned above, the cable from the mainland is the basic source, and is likely to remain so in the future. However, as the island grows, this cable may become a limiting factor.

It is crucial to understand the difference between electric energy and electric power. Imagine a cable able to handle 100 kilowatts of electric power. If the cable were used to capacity all year, the amount of energy transmitted would be 100 x 8760 (the number of hours in a year), or 876,000 kilowatt-hours (kWh) per year.

In reality, however, the cable is seldom used to capacity. It might for example be used on the average only at 10% of capacity, transmitting 87,600 kWh per year. Yet its instantaneous capacity remains 100 kW.

Because of the schedule of human and industrial activity, the need for electricity peaks during the day, with daily peaks varying during the week and, more importantly, during the

Fitz Sargent

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year. In a city, peak loads can occur both on a hot summer afternoon and on a cold winter night. The mix of users and their specific loads determines the "shape" of the load and the likely electric power requirement – the demand – under the most stressful conditions.

We did not have the data to examine load questions in detail. A careful study of expected power demands should be made, and the data related to the size of the cable, the capacity of the on-shore utility, and the needs for growth. It is conceivable that an additional power cable could be required in order for significant growth to occur.

Alternative sources of electric power are not at this time economically feasible. Windpower has not worked out uniformly well on the east coast island sites where it has been tried. Photovoltaic power is dropping rapidly in price, and is increasingly cost-effective for islands without a cable, where the alternative is fuel-powered generation. For grid-connected communities, PV in cloudy Maine may not be a practical alternative for another decade or two. Even so, it will see increasing use, and can help cut down on the amount of electric energy imported from the mainland. It is unlikely that PV will help solve the problem of demand, since peak loads do not occur during periods of peak PV output in the Maine climate. Batteries are an expensive adjunct to PV, and should be avoided except where necessary for sites not served by power lines.

Sources of Fuel

Obviously, propane, gasoline and #2 oil (diesel fuel) will continue to be imported from the mainland as needed for boats, cars, trucks, planes, powered equipment, cooking, backup generators, etc. Island residents should carefully watch the economics of fuel-switching as a means of conservation. Other means of conservation are discussed in the next section.

Wood fuel is obviously a prime opportunity for the island. Our projections are for 3000 cords per year of wood fuel within 10 years, and 6000 cords within 20 years, on sustainable, managed tree-farms. One good use of wood fuel is in heating greenhouses; 50 acres of wood will support one acre of greenhouse.

Conservation and Solar Heating

On-site solar heating should be incorporated in new housing as far as possible. Experience shows that a modest amount of passive solar heating can go far to heat a very well insulated home. Over-glazing is not a good idea, except for luxury housing or for solar greenhouses used for food production. The rule of thumb for Vinalhaven is likely to be 15% of the heated floor area in south glazing, at a maximum.

Conservation in all its forms should be the keystone of an island energy program. Given the fragility of the island energy supply, its very high cost, and the almost endless ways of conserving energy at a modest cost, no other energy measure can touch conservation in cost-effectiveness.

New construction should be built to the highest standards of superinsulation, a technology in which Maine is a world-wide leader. It is highly unwise to compromise on this issue. For example, building out of unseasoned lumber in order to use island-cut wood is a poor idea, because it is nearly impossible to control air leakage in a house unless construction wood is kiln-dried.

An intelligent conservation program is an important element in our proposed program to encourage involvement by the townspeople in their own future.

Food

Currently, fruit, vegetables, pigs and sheep are raised for local consumption in limited amounts, as explained in the first section on the island's history. With a larger population, there is a need and an opportunity to expand the island's agricultural base.

There is room on the island, through the controlled clearing of forests next to existing farmland, to develop at least 230 acres of productive farmland, divided as follows among various types:

Truck gardens:	50 acres (employing 25 persons)
Farmland:	30 acres
Pasture:	150 acres

In addition are individual gardens, which contribute to the seasonal produce of the island.

About 10 acres are projected for intensive greenhouse agriculture. Solar greenhouses can extend the growing season substantially, and expand the variety of produce grown on the island. Greenhouses are also more efficient. Ten acres in a greenhouse can produce substantially more than ten acres of garden.

Employment and Industry

The essential element in a proposal to expand the island's year-round population is providing jobs for an expanding population.

"It is unlikely that PV will help solve the problem of demand, since peak loads do not occur during periods of peak PV output in the Maine climate."

Jacek Von Hennebergs

Developing the following list of potential jobs for island residents occupied a large part of our time during the Design-In, and is in many ways the core of our work.

It must be admitted that in many cases we have stretched the possible job opportunities to the maximum. The proposed rehabilitation of the granite industry is an example. To provide 30 year-round jobs requires a substantial and enduring demand for granite. As a result of recent changes in architectural styles, this demand is undoubtedly now present. The persistence of this demand depends upon a stable economy, a continuing market for high-quality office and public buildings, and a continuance of the current trend towards historicist architecture. No one can predict continuation of such an uncertain set of factors. Balanced against this intrinsic uncertainty is the possibility that modern marketing methods would identify a continuing use for granite despite changes in architectural style, once the industry was reestablished and in need of continuing markets.

For each industry, listed below, we started with estimates of the existing jobs. Then the potential for growth was defined, job by job, ending up with a total of added jobs. Not until we had determined the possibility of employing all the proposed year-round residents did we finally settle upon a number for the island's future population.

Fishing

The fishing industry dominates the Vinalhaven job market, and in addition provides the town with its primary image as a fishing village. Lobstermen are leading citizens, and in recent

HOUSING AT FERRY LANDING VINALHAVEN

Jacek Von Henneberg

years many have made substantial incomes. Despite the dominance of fishing, it is evident that there is little possibility for growth in the island's fishing industry.

The lobstering industry is now saturated; indeed, the disastrous harvest of 1984 may indicate over-saturation. There is some room for growth in local fishing, but real growth in the fishing industry is unlikely. To expand, the island's fishermen would have to use larger boats which stay out longer and freeze the catch on board. These boats logically and traditionally operate from shore-side ports, where larger fish-processing plants are located. The advantages of an island location accrue only to a more local fishing industry, which is almost saturated.

Here is the breakdown of existing and projected jobs in the fishing industry:

Trade	Existing	Future Added Jobs
Lobstermen	125, operating 75 boats	None
Gillnetters/ Seiners	35, operating 10 boats	15, with 5 boats
Clammers	15	None
Aquaculture	3	15

Fish Processing
The new fish processing plant on the island employs 40 persons. We project an expansion to 60, employing 20 new people, largely to accommodate the expected increase in the number of gillnetters and seiners.

Boat Building/Repair
From the 5 existing jobs in this industry, we project an increase of 25 to a total of 30 jobs. This large percentage increase anticipates the general increase in boating among the nearly tripled year-round population. Given a continuing source of year-round work, local boat builders and repairmen could command some of the seasonal work which is now done largely on the mainland. Finally, the increased population would generate a certain amount of boat traffic to supplement the ferry service.

Services
The number of permanent, year-round jobs in the island service industry is obviously dependent upon the number of year-round citizens. Our estimated distribution (based on averages) of the 65 existing service jobs finds 10 in retail trade, 10 in building construction, 12 in the island school, 5 in municipal jobs, with the remaining 28 in a variety of other positions. We project that the total will nearly triple to 180 jobs, divided up among the various subcategories.

Tourism
Tourism is a special case of service job, intended to serve the seasonal population. The numbers represent full-time equivalent jobs, since some people deal with tourists in the summer, and take another job during the rest of the year. Presently, there are about 5 full-time equivalent jobs in this industry, which will grow to 50 with the addition of the hotel and tourist facilities which we project.

Agriculture/Forestry
As noted above, we feel there is an opportunity for substantial growth in agriculture and forestry, partly to serve the increased population, and partly to exploit the forest resource on the island. Where there are now 5 jobs, we are confident that at least 55 can be added.

Arts and Crafts
As with the rest of Maine, a mail-order and tourist-oriented cottage industry based on arts and crafts can thrive on Vinalhaven. Many artists favor an island location. We project an increase from the present 3 jobs by at least 20.

Granite
As noted above, changes in architectural style indicate the possibility of reviving the moribund granite industry on the island. We project 30 new jobs in this industry.

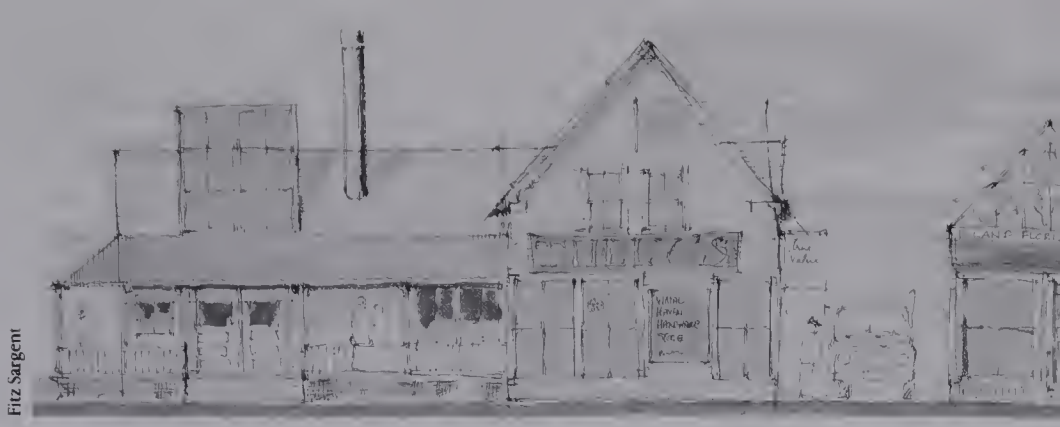
Remote Professional
The rise of computers now makes it possible for professionals, such as management consultants, to operate successfully from a remote home office. Despite the bitter winter climate, the beauties of the island will attract year-round professionals, and we project at least 20 remote professionals on the island.

Light Industry
Other than fishing and its related activities, there is no industry on the island. Light industry, particularly semi-conductor assembly plants, need a secure source of relatively unskilled labor, typically the wives of employed men. Such a labor pool exists on the island. Given batch-processed products with no great weight, the island location would not be a major disadvantage for the right industry.

As an example of a possible mix, we project three new industries on the island: one employing 75 persons; one 35 persons; and one 40 persons, for a total of 150 persons.

"Wood fuel is obviously a prime opportunity for the island."

"... no other energy measure can touch conservation in cost-effectiveness."



Fitz Sargent

The Next Steps

Our proposals are intended to be as realistic as possible, given the limits of time, the lack of detailed information, and the remoteness of the participants from the island itself.

Despite our efforts, it is certain that many, perhaps most of the residents of Vinalhaven will feel that this study is an invasion of their privacy and an attempt to take over the management of their lives. We regret this, and offer the following comments to justify our arrogance in looking at Vinalhaven's situation when Vinalhaven has not asked for our help.

It is often the case that apparently stable systems are in fact undergoing change below the surface, or are threatened with change through forces growing outside the system. An extreme example is the peaceful town which is overrun in a war, perhaps destroyed or depopulated suddenly and without warning. Perceptive persons might know of the preparation for the war, might be able to predict its course, and might move out of the way. Often this is impossible; or the prediction is not certain enough to justify the wrenching readjustments necessary to avoid the danger.

So it is with less life-threatening changes. Peaceful towns suddenly find themselves overrun not with soldiers, but with tourists or developers. The citizens, unprepared for the invasion by sophisticated, wealthy outsiders, have their land effectively confiscated (by selling land at apparently high prices, only to see the developer resell at staggering profits). Or they see the fabric of their town disintegrate under the impact of new economic forces.

Often, citizens who live in a lovely town, but are not wealthy, eagerly sacrifice the town's beauty for security and economic gain. It is the visitor who suffers the loss, as he or she returns to the sacred and beautiful village, only to find it surrounded with shopping centers and invaded by fast-food facilities.

In our discussion, we confronted our wish to have our cake and eat it too. We wish to see the island prosper, but at the same time hope to save the beauty and resources of the island for future generations to enjoy. We know this is possible, because it has been done many times in many places, given an informed and dedicated citizenry willing to fight complacency, resistance to change, and a belief that unregulated development is one of the rights guaranteed by the Constitution.

It is useless to argue this point on the basis that the outcome is handsomer, since the route to a handsome and prosperous future requires major changes in the attitudes of its citizens. Rather, we have chosen to argue from a different perspective, that of sustainability.

We believe strongly that random, laissez-faire development, following the whims of fortune and the desire for short-term economic gain, would lead the island further and further into a destructive dependence upon remote forces. The islanders would gradually lose their autonomy, since all the economic forces in their lives would be guided by persons remote from the island.

An alternative to this increasing control from the outside is to exploit to the utmost the possibilities for local self-reliance. One cannot carry this to extremes, since in no way can the island exist with a 20th century standard of living without extensive ties to the social and industrial fabric of the state, the region, the country and the world beyond. But one can ask, in each case, at what level of community – local, state, regional, national, or international – can the problem best be solved.

We have outlined a possible and admittedly idealized path toward a better, more prosperous, more stable and more self-reliant community. In our view, a larger population paying more attention to local agriculture and community infrastructure can survive indefinitely. By contrast, a community of individuals acting for their own benefit without regard for the long-term health of the community as a whole would inevitably become less stable, less self-governing, and probably less prosperous relative to the region. There is even the possibility, now being faced on other Maine islands, that the community might not survive as a viable economic entity.

Those on Vinalhaven who share our general viewpoint are likely to find some use for our speculations. For those people we offer the following suggestions for the next steps.

Review the Data

Our work is based upon well-informed sources, but our data lack detail and in many cases are not up to date. For example, we do not know exactly the current population of the island. The next step is to accumulate accurate data, and review our findings in light of those data. If the data do not support the findings, then our conclusions must be modified or abandoned.

Part of this data gathering is of course the devel-

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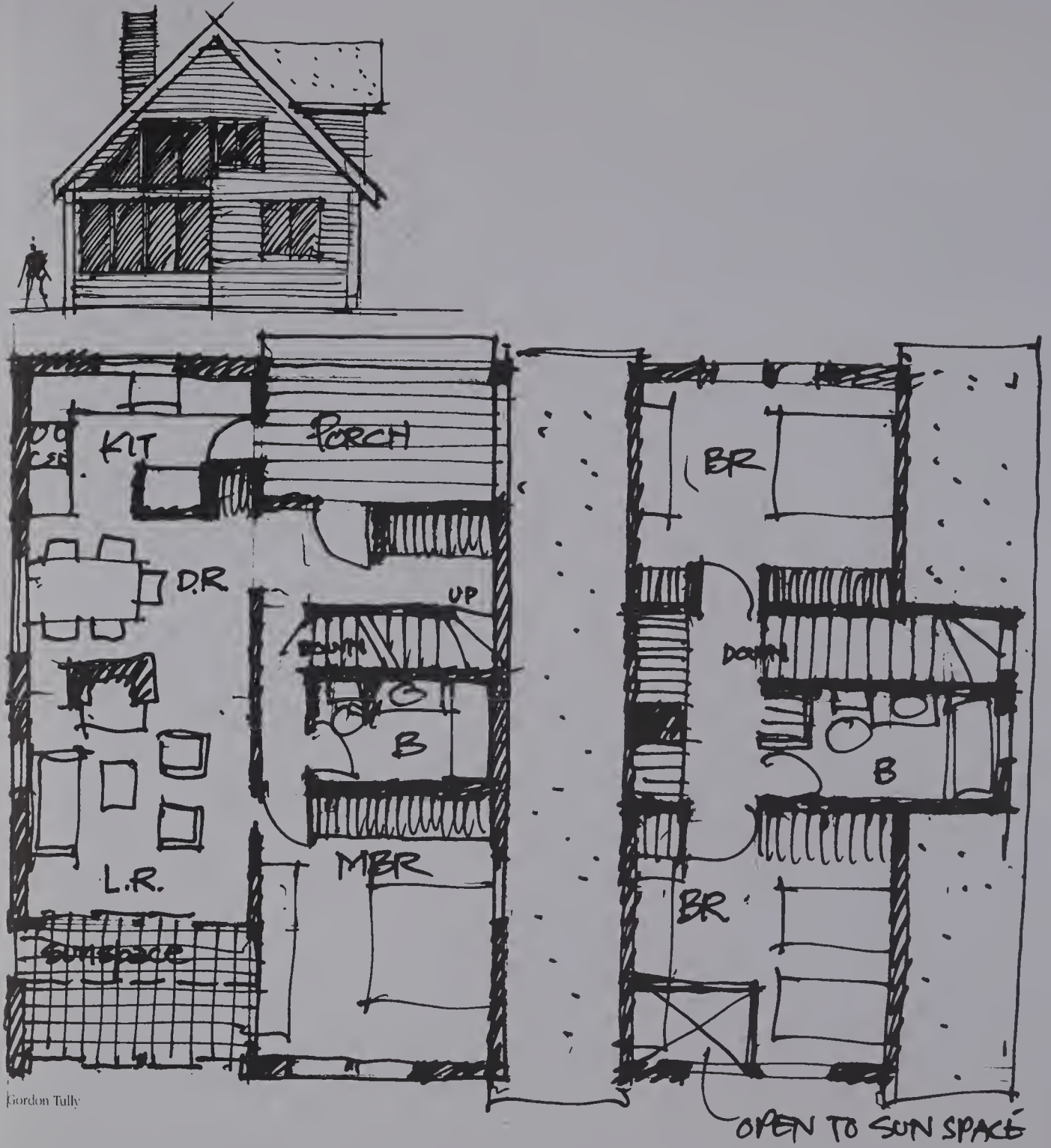

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"It is often the case that apparently stable systems are in fact undergoing change below the surface, or are threatened with change through forces growing outside the system."

Jacek Von Hennebergs

opment of accurate maps of the island, along with information about landholdings. We expect that such information is not as readily available as it might be in a larger community, and that funding is needed to completely map the island.

Citizen Involvement

Before any steps are taken to modify or carry out proposals such as those we suggest, it is crucial to begin the development of a consensus. In one sense, developing a consensus is the entire task, but it is a separate activity from inventing technical solutions to problems, and can be done most effectively by different groups of actors. Technicians concentrate on the physical shape of the problem and not on helping people change their minds.

In the end, what is done will be determined by the depth and commitment of this consensus. It can be called public education, but that is an arrogant way to put it, implying that one group knows what is good for the others. Rather, it should be seen as the result of a public dialogue, in which those who devise technical solutions listen to and absorb the real world problems of those who must live with the solutions. Both sides always benefit from these exchanges, even when one or the other feels that things are moving too fast or too slowly.

Refine the Technical Solution

There are many points in this brief proposal which depend upon sophisticated technical information or complex tradeoffs. For example, the suggestion that the power cable should be replaced if damaged or destroyed depends upon our estimate of 2 to 3 million dollars for a replacement, spread over all the residents of the islands, summer and winter. If the cable were to cost substantially more, or if the burden had to be borne only by the year-round citizenry, the conclusion might be very different.

Another example is the belief we hold that the landfill will be adequate to deal with solid waste on the island for the indefinite future. Perhaps leachate from the fill is already contaminating ground water, and an alternative location cannot be found. Attention would then have to be paid to alternative methods of solid waste disposal, a problem being faced by nearly every community across the country.

No one has "the answer" to any question – judgment is needed at every step. Professionals make their living making judgment calls, and even the best of them are used to being wrong some of the time. The average citizen cannot understand why an expert cannot always be right, or does not know the answer to a question. The only defense against this problem is constant education of the citizens in the limits and uses of professional judgment, and the selection of professionals who can admit mistakes and adopt a proper humility.

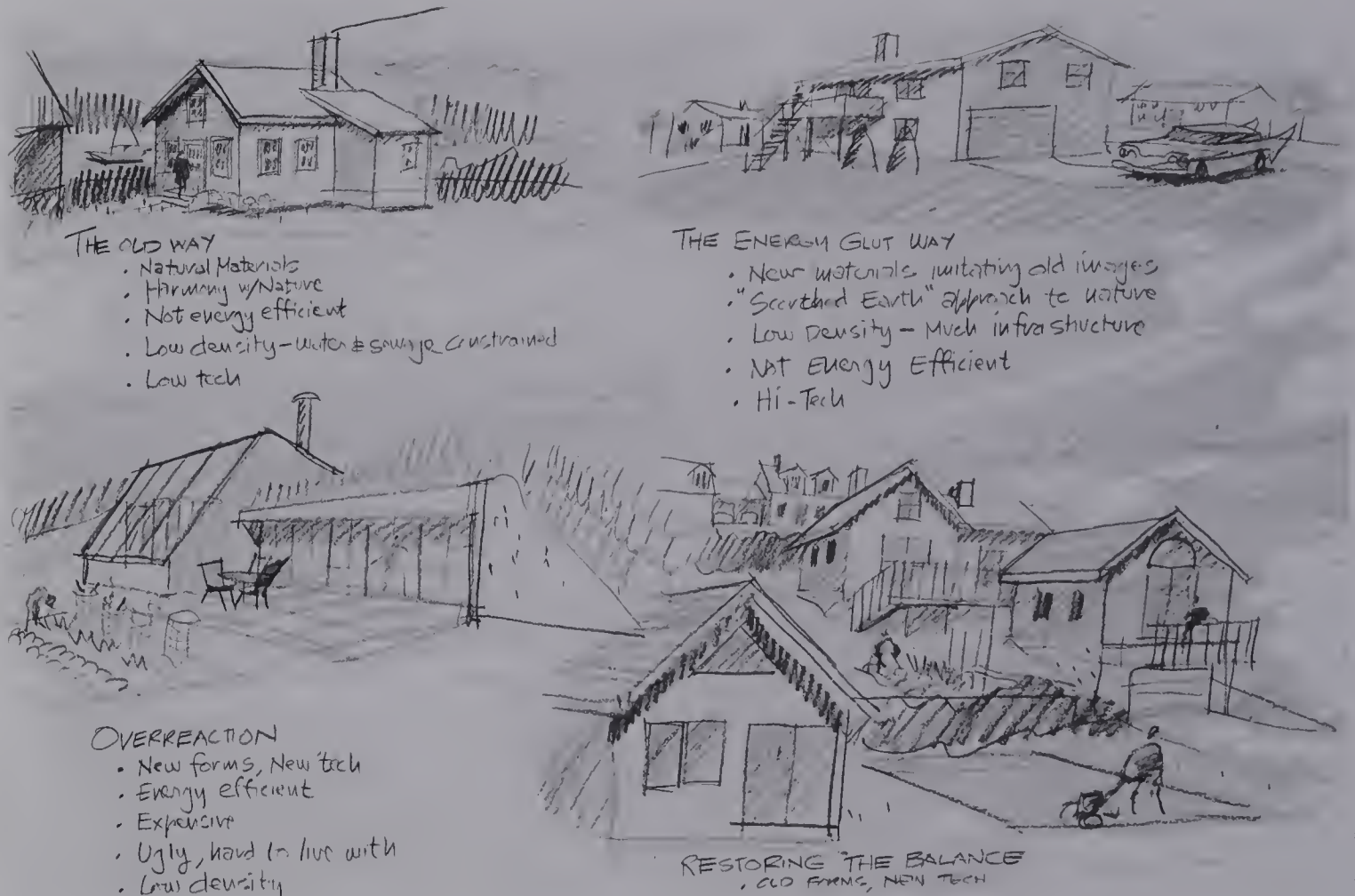
Find Ways to Implement the Solution

We have suggested two possible ways to deal with sewage. There are many more options, and they must all be explored. This will require engineering studies, which will cost money. To obtain study money, the town will have to accept deeper state and federal involvement in its sewage problems, unless private study money can be found. This sort of dilemma will be found at every turn, and only with time will a group of dedicated citizens be able to see the project through its many stages of implementation.

Part of the job is a selling task, trying to attract and hold the kind of industry the town wants. Part of the job is the development of workable zoning and building codes, which help direct the proposed new development in the town. No town has an easy time with such matters, and potentially tripling the size of a community makes the problem much more difficult.

"Money makes the world go round," and so implementation, like study and fact-finding, requires attention to sources of funding. Such matters were beyond the reach of our group, and indeed change from year to year as legislation comes and goes. With active lobbying an alert citizen group can bring in funds from state, regional and federal sources which escape less aggressive communities.

No doubt professional help will be needed, perhaps in the form of a full-time planner. It is reassuring (perhaps to some, threatening) to know that throughout the region are dedicated and interested professionals who feel strongly enough about rational, sustainable development to dedicate some of their time to Vinalhaven's situation – our group itself demonstrates this. The community should call upon such help wherever it can be found.


THE OLD WAY
• Natural Materials
• Harmony w/Nature
• Not energy efficient
• Low density – water & sewage constrained
• Low tech
THE ENERGY GLUT WAY
• New materials imitating old images
• "Scorched Earth" approach to nature
• Low Density – Much infrastructure
• NOT Energy Efficient
• Hi-Tech
OVERREACTION
• New forms, New tech
• Energy efficient
• Expensive
• Ugly, hard to live with
• Low density
RESTORING THE BALANCE
• OLD FORMS, NEW TECH

Gordon Tully

"In our view, a larger population paying more attention to local agriculture and community infrastructure can survive indefinitely."

"... environmental quality is directly related to that elusive characteristic known as the quality of life, even if it is not included directly in measures of 'the standard of living.'"

Dick Morchouse

VII Water and Waste Issues

Albert M. Presgraves

Sustainable design implies a balanced relationship between human activities and the natural environment. The question is, "what is balanced?" It seems that it is easier to define situations where the balance has been lost and the environment has been damaged to such an extent that it is unsafe for human activity. But more often, environmental degradation is subtle: trash along the roadside, foul odors in the air, rainwater that corrodes structures and stunts plant growth. Is this really the price we have to pay to maintain our culture and society, or do these environmental effects cause distress and anxiety throughout society and thus degrade our culture, whether the decline is measurable or not?

It is generally accepted that environmental quality is directly related to that elusive characteristic known as the quality of life, even if it is not included directly in measures of "the standard of living." Certainly, society as a whole has been actively involved in maintaining and protecting environmental quality over the past decade or more. It appears that these actions have some meaning that is more important than what a simple cost to benefit ratio might measure. Assuming that a clean environment has meaning to people, then as it is achieved people will be more comfortable with their life situation, and will be able to concern themselves with more personally rewarding activities.

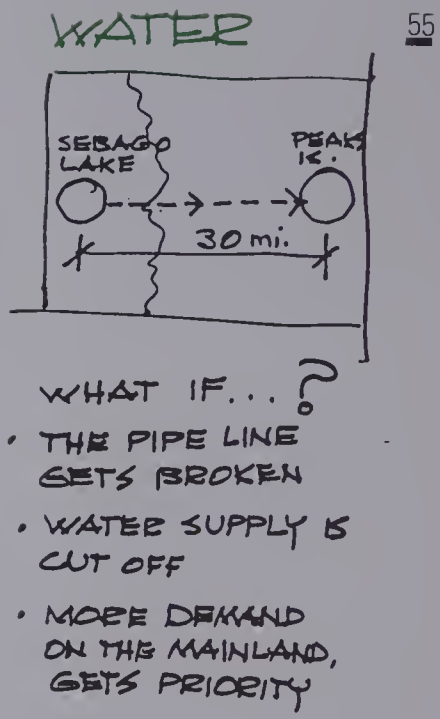
General Relationships

All of our material possessions are the product of the earth's natural resources. To follow the path of each resource from raw material to manufactured object would be a monumental task. Analyzing the information in any meaningful way would be even more complicated. In order to simplify these complex relationships, our point of view was intentionally limited to the categories of water and waste.

The one resource that is essential for sustaining human life is water – water that is clean and relatively abundant. Our use of water implies that the water will become less than clean, or, in a word, polluted. Does this polluted water cause a negative impact on the natural environment? Even more importantly, what does our management of the water resource show about our relationship to the natural environment? Is there a way to process the "waste" water so as to benefit the whole natural system in which we live? Is there a way to (economically) increase the system's order, rather than to allow dilution to be the solution? The issue of water (and waste water treatment) seems to be critical to understanding our resource management practices.

Another management practice that reflects on our relationship to the natural environment is the manner in which we dispose of our solid waste. Except for a small quantity of precious metals or gem-quality stones, all material goods eventually become waste products. Along the path from raw material to waste product, energy has been expended that cannot be recovered. Increasing the efficiency of the overall process should result in a net benefit to the overall system's "economy."

The general relationships described above are well known facts. It is the relative importance of the various facts that shapes the specific solution to any given problem at a given time that must be determined; what we are investigating as part of this design exercise is the meaning of



Sally Harkness

COLLECT RAINWATER FOR...
- TOILETS
- WASH. MACHINE
- WATERING

DEEPEN EXISTING WELLS

our design solutions. We believe that solutions to resource based problems should be considered from a long-term perspective. This perspective requires that both human needs and environmental factors be equally considered within the overall system. We are assuming that there are solutions currently available which would restore balance and harmony and result in a substantial improvement for the overall system.

Context/Determining Factors

Transferring general principles to specific cases is a major task of any design problem. In many instances today, the design process becomes a technical exercise that is fixed on a specific goal. Even the not very technical issues of social and environmental impacts are analyzed according to technical procedures. Since we are concerned with the human and environmental elements of design, we are attempting to broaden the perspective that is used to evaluate a given problem.

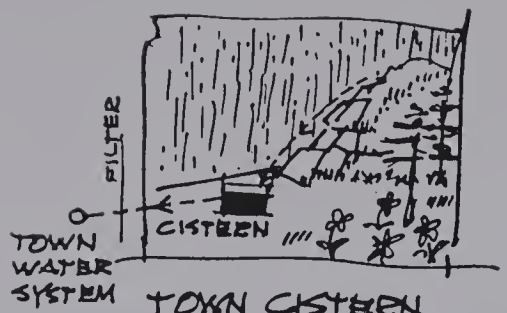
But without some structure, or limits to work within, a problem can become irrelevant. This is why this exercise includes some practical considerations. We want to develop design solutions that are both sensitive to real-world realities, and based on principles of sustainability.

In terms of the water and waste issues of the two design locations, we can divide our solution analysis into three categories: 1) the social/political reality; 2) the technical issues; and 3) the environmental/philosophical considerations.

The social/political reality is one of the most difficult to fully understand, because it underlies all that we do. We have generally limited this consideration to a review of the institutional requirements of any proposed solution. A "solution" needs to be legal, and it needs to be approvable by any regulatory agency that may have jurisdiction. To some extent, even these evaluations were based on assumptions and best guesses. And certainly, assumptions were made in defining the future growth patterns and other future characteristics of the two islands' examples. The economics of a proposed solution are also important, but this consideration was limited only to a possible/not possible review. Because these assumptions were necessary, the design solutions were kept as flexible as possible in terms of the technical details.

Given that any proposed solution is very dependent on social/political constraints, the technical issues become less important. This is not to say that any solution need not be technically feasible, because it certainly must be, but it is worth noting that many more things are technically feasible than could ever possibly be implemented. This fact has been demonstrated by the many "sustainable future" scenarios that have been developed in minute detail, but which have never gotten beyond the paper they were printed on.

The environmental/philosophical consideration was one of the major tasks of the process. Determining which combination of technical details provides the most sustainable design solution made for interesting conversation and thoughtful reflection. It was this process of developing alternate solutions and creating new ones that eventually produced the proposed solutions.



TOWN CISTERN
- FROM HIGHEST POINT OF LAND
- CLEAR ROCK FACE
- FILTER + PIPE TO TOWN WATER SYSTEM

Sally Harkness

Vinalhaven Case

The water and waste situation on Vinalhaven is substantially different from the Peaks Island case. Vinalhaven is almost completely self-reliant for its own water and waste disposal services. The environmental and development conditions on Vinalhaven are also more amenable for providing these services. Unfortunately, not as much information was available about the details of the existing situation, so the recommended solutions are not as specific as those developed for the Peaks Island case. A resource flow chart is illustrated in the diagram.

Solid waste disposal is currently handled by a landfill site near the center of the island. Apparently, sufficient cover is available to operate the landfill in a proper manner. Landfill life and environmental impacts were not well documented. It is suspected that recycling of waste material off the island might not be feasible because of high transportation costs. Certainly, recovery of reusable items should be encouraged through a "swap shed" operation at the landfill. The fact that people individually transport trash to the landfill collection system makes the concept of recycling more feasible to implement than on Peaks Island.

Given that the proposed scenario for Vinalhaven includes a substantial increase in population (concentrated in the existing village area), then a more detailed evaluation of the solid waste system should be conducted. We assume only that the landfill will be maintained or expanded so that it meets all regulatory guidelines. Any reductions in the waste load to the landfill would be good, so recycling in any form is desirable.

Currently, fish waste from the new processing plant is transported off the island. This is a potential resource that could be utilized to make fertilizer or animal feed. However, the relatively small scale of the operation makes the economics unattractive, unless offsetting benefits could be shown.

Water supply on the island is more than adequate for the existing community, and for the proposed increase in population. The piped system would be expanded in the new residential development, while on-site wells would continue to serve in the outlying areas.

The major waste issue on Vinalhaven is sewage treatment. It is reported that significant pollution of Carver's Pond is now occurring, and this implies that Carver's Harbor is in a similar condition. This situation is not surprising, given the protected nature of the two adjacent water bodies, where tidal flushing is not significant.

Some form of sewage treatment is certainly required in the mostly developed Carver's Harbor area. Although primary treatment was considered sufficient for Peaks Island, the environmental conditions at Carver's Harbor on Vinalhaven are significantly different. Perhaps if no increase in population were envisioned for the town of Vinalhaven, then on-site or other limited scale improvements could be adequate to alleviate the existing pollution problem. But given the proposed population increase, a somewhat conventional "central" collection and treatment system is proposed. The system should be designed for low energy consumption and efficient operation. The system would be considerably larger than the Peaks Island system, so a complete aquacell system would be too large, although operating costs would be low. We propose a small pre-engineered surface contact system (RBC or trickling filter) for pretreatment during the summer with final treatment in an aquacell or by land application methods, if an appropriate site could be found. In the winter, the small treatment plant would be sufficient without the final treatment step, with liquid discharge into the harbor. Sludge disposal would not be a major problem given the small volume and the size of the island. Alternatives would include liquid spreading on agriculture land, drying and landfilling, or dewatering and composting.

Peaks Island Case

Water service to residents of Peaks Island is supplied by a variety of methods, as described previously. We support the general concept of maintaining the existing water pipe system and using private wells in more remote locations. A major problem with the buried water system is the amount of leakage in the system. It is hoped that some effort will be made to remedy this situation.

Waste water treatment on Peaks Island is of more serious concern. The developed areas of the island are serviced by a combined sewer system that empties directly into Casco Bay at two locations. About 75 dwelling units are serviced by this system. Other houses are serviced by a wide variety of systems.

About half of the houses located along the shore have direct discharge pipes into the Bay. The remainder of the houses have some form of on-site treatment and disposal system. The oldest houses are connected to cesspools that drain into the ground without any septic tank

"Except for a small quantity of precious metals or gem-quality stones, all material goods eventually become waste products."

"We are assuming that there are solutions currently available which would restore balance and harmony and result in a substantial improvement for the overall system."

"... many more things are technically feasible than could ever possibly be implemented."

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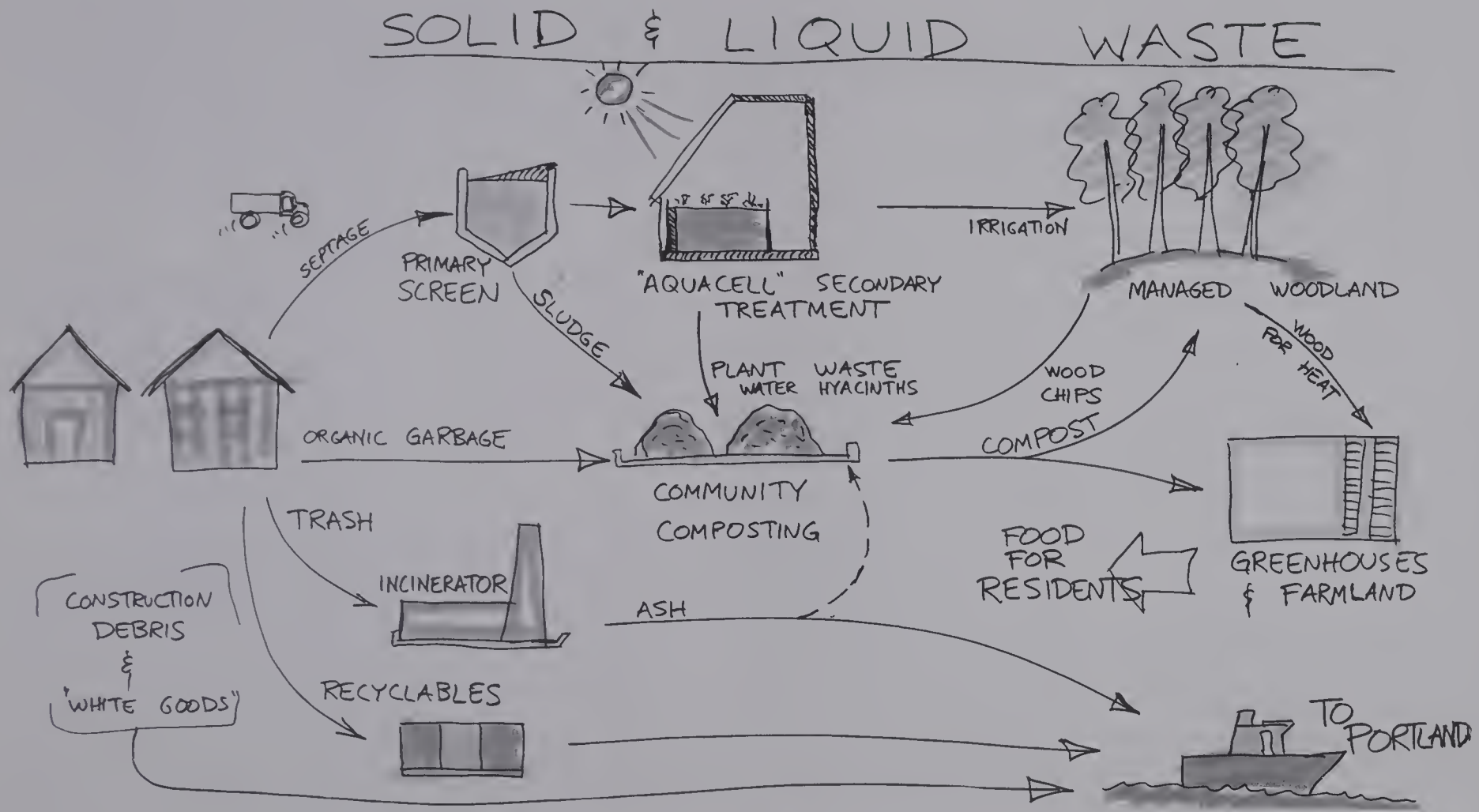


Albert Presgraves

treatment. The newer buildings have more adequate systems, with a septic tank and some type of soil absorption system. A number of homes with on-site liquid disposal systems have experienced problems with their operation.

Evaluating the pollution impact from the existing situation is difficult. Certain specific on-site systems have obvious problems with ground and surface water contamination. Other systems may be contaminating the ground water on the island, but no data are available to substantiate the suspicions. The direct discharges into Casco Bay are certainly causing some adverse impacts on water quality. However, Peaks Island is one of about twenty locations on the East Coast that has been granted a temporary waiver from the EPA which allows them to provide less than the standard level of secondary treatment quality. It is our belief that this waiver should still require at least primary treatment – settling of the suspended solids in the sewage, with the remainder flowing into the Bay.

Septic tanks should be pumped once every three or four years. There is currently one contractor on the island that provides this service. The septage is spread on a field and covered with sand or gravel. This disposal method meets State approval, even if it does not provide a method of utilizing the potential nutrient resource of the septage.

Given the existing "status quo" situation, and the excessive cost of providing any type of conventional, secondary-process treatment plant, a minimum-treatment scenario was developed. This would entail the improvement of all the individual and city-owned systems to include a septic tank treatment step before discharge to the ground or to Casco Bay. The sludge from these tanks would need to be removed occasionally for final treatment and a disposal method that returns the organic nutrients to the island's environment. This solution is further developed later in this section.

The other waste issue important to the island is solid waste disposal. The current practice (up until October 1984) has used a dump site for disposing of virtually anything that people wanted to throw into it. There has been little management of the site and the Maine Department of Environmental Protection has requested that it be closed. Most household garbage is collected by a City Public Works crew and is transported off the island. The small amount of household or putrescible garbage that is placed on the dump site creates the major problem with the dump operation. Cover material is not readily available, and is expensive to procure from off the island, so uncovered refuse at the dump regularly creates a health hazard. These problems are recognized by the City of Portland, and measures are being developed to alleviate the situation.

In order to assist the City in developing a solution, the Greater Portland Council of Governments performed a study and report entitled "Portland Islands Solid Waste Alternatives." This documents showed that a landfill which complies with current environmental regulations would be prohibitively expensive because of the scarcity of cover material. Two other options were studied for Peaks Island. One was to transport all garbage and waste material off the island, except for brush and demolition debris, which would be stockpiled, burned if allowed, and then buried, presumably. The last option was a small modular incinerator, with the suggestion that glass material be recycled, if the residents would separate it from their other trash. Based on a cost evaluation, the incinerator was recommended, but transporting the refuse materials from the island has a comparable cost.

We believe that recycling is clearly the best method of "disposing" of any waste, assuming that it can be separated easily and handled without a substantial cost burden. In fact, large metal items and tires are two materials that are currently stockpiled and removed from the island when there is a sufficient quantity. To keep the handling cost at a reasonable amount, the separation of materials must be done by the individual households, with categories such as: newspaper, glass (by colors), metals, mixed paper and plastic, and organic garbage.

The key to solving the solid and liquid waste problems on Peaks Island is twofold: 1) improved management and operations; and 2) the allocation of investment capital to build the necessary infrastructure. Above all, the solution must be practical, and this implies a high degree of efficiency. Numerous ideas were discussed that did not meet these criteria. These included any sewage treatment system that required a substantial amount of operation and maintenance, since the cost would be excessive. Also, a solid waste incinerator with significant heat recovery or energy production would not be practical since seasonal variations don't match the need for energy or heat, and the size is too small for efficiency.

The idea of combining the two waste streams

"The major waste issue on Vinalhaven is sewage treatment."

"About half of the houses located along the shore have direct discharge pipes into the Bay."

"The idea of combining the two waste streams (solid and liquid) for treatment became the central thread of the proposed system."

"... a minimum-treatment scenario was developed."

(solid and liquid) for treatment became the central thread of the proposed system. This idea was based on the feeling that such a system would be very efficient, both economically and environmentally. For instance, the organic portion of solid waste is generally high in carbon, but low in nitrogen. Septage or sewage sludge is relatively low in carbon and high in nitrogen. When the two materials are combined, the nitrogen to carbon ratio is close to ideal for composting or other biological treatment. The various components that are incorporated in the proposed system are described in the following paragraphs and the diagram of the proposed flow.

For truly sustainable and efficient solid waste utilization, the solid waste must be separated and managed for optimum use or reuse of the materials. The separation of the waste into five (or more) categories is assumed to be completely performed by the individual residents. This is admittedly the most idealistic aspect of the whole proposal. Delivery to the facility could be by the residents, by a hauling contractor, or by a City collection crew. The five categories of solid waste are: newspaper, glass, metal, mixed plastic and paper, and organic garbage. In addition there would be stockpiles for metal appliances (white goods), tires, construction debris, and brush/trees.

An incinerator is used for reducing the volume of plastic and mixed paper that must be removed from the island. Although we were not convinced of the benefits of such a system, we included it because the City apparently anticipated the capital investment. Whatever ash remains from the incinerator would be transported off the island for regional disposal, along with unmarketable mixed metal and plastic items, and non-burnable construction debris. Even if recycling is not as complete as described here, it could still provide a benefit to the overall operation's expense.

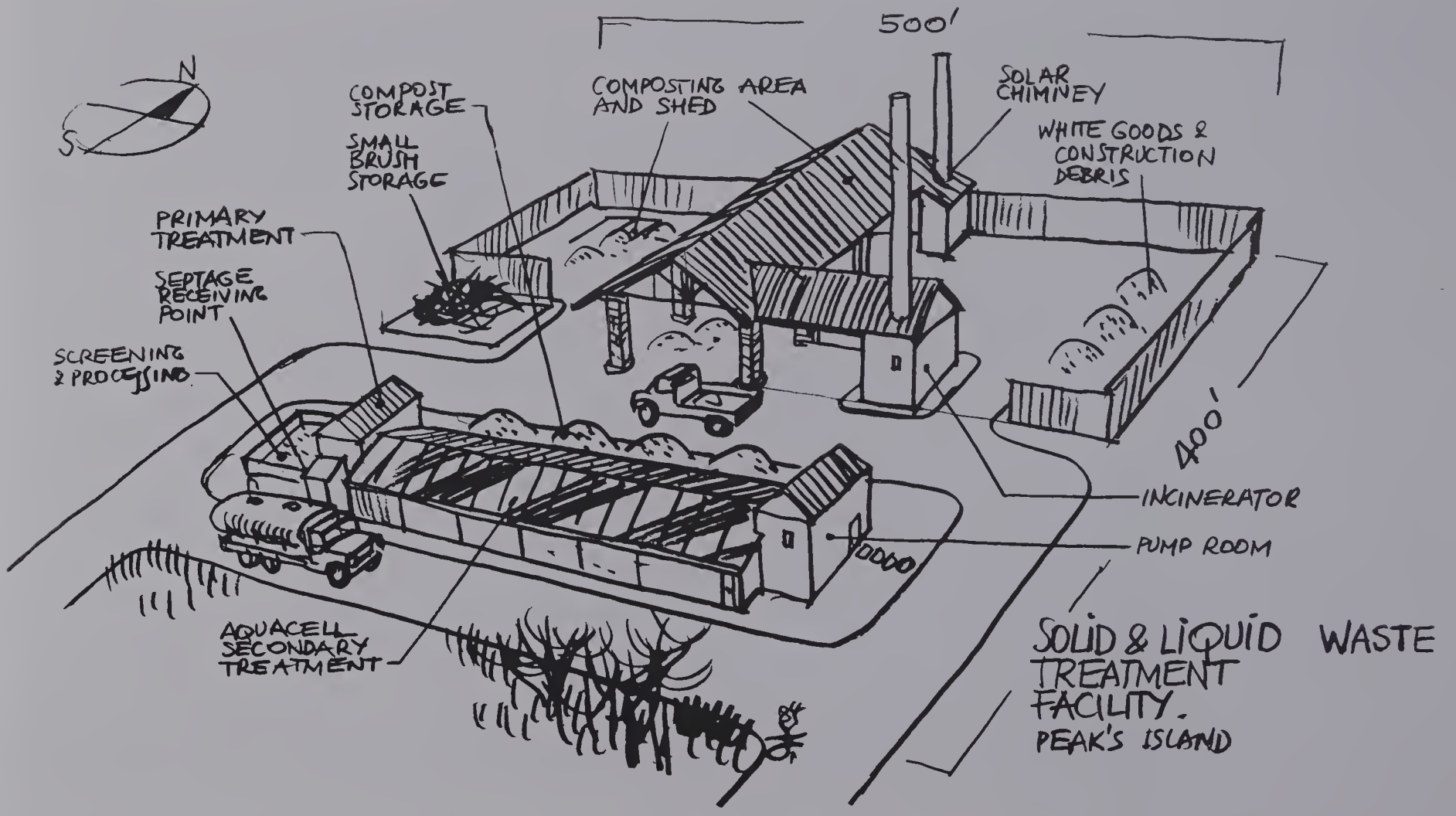
Another key component of the proposed system is composting of combined sewage sludge and organic garbage. Such a system would require some equipment and instrumentation, as well as a supply of wood chips to act as a bulking agent in the process. The wood chips would be made from the brush and trees stockpiled. Finished compost would be used by individuals or groups to improve the quality of their soil. Rainwater runoff from the composting and the stockpile areas would need to be treated before release to the environment, so it would be piped to the beginning of an aquacell treatment system.

The aquacell treatment system would accept septage sludge from all the island sources during the six summer months only. This is when there is sufficient light to biologically treat the wastewater. The first stage of treatment would be a pre-aeration tank, to convert the septic solution to an aerobic condition. A screening and grit removal process would yield some solids that would go to the aquacell, where natural aquatic plants would absorb the nutrients. The final step would be a chlorine disinfection process with the treated water being irrigated into the forest. The aquatic plants, such as water hyacinths, would be harvested occasionally and taken to the composting operation. Solid material that settled in the aquacell would be removed once a year for composting. During the winter, only a minimum flow from the composting and stockpile areas would enter the facility.

The system described above is shown as an integrated facility. Some design data are listed below:

Peak population	= 5,000 in 950 houses
Flow	= 1,000 gallons per day (6-month operation)
Total Solids	= 2,500 mg/l; 200 lb/day
Aquacell	= 60 days detention time

"Another key component of the proposed system is composting of combined sewage sludge and organic garbage."



"The most populated of the Casco Bay Islands, Peaks' year-round resident count of 1200–1500 swells to approximately 5000 during the height of the summer season, and this number is increasing."

Leslie Horst

VIII Peaks Island: Design and Recommendations

Existing Conditions

John Crowley

Problem Definition

Southern Coastal Maine, defined by the State Planning Department as predominantly urban and suburban, has experienced a 38% rise in population during the past decade. Much of this growth has been highly concentrated in the Casco Bay region. As a result of the population migration to Portland and surrounding communities, the Casco Bay Islands, with relatively easy access to the downtown area of Portland, are in the midst of a steady growth cycle the likes of which has not been seen since the end of the last century.

The development pressure resulting from the city's growth and an increase in the islands' summer and year round population have begun to raise a variety of issues and concerns regarding the islands' future character and livability. Many questions have provided the focus for developing a schematic master plan: zoning and land use; population growth and stabilization; waste disposal and management; changes in character and quality of life; water supply availability and the role of conservation; a lack of local employment opportunities, local agricultural prospects; energy conservation and production; and what the future of coastal development might be. This plan is based on concepts of sustainability and their application to the future development of Casco Bay's most populated island neighborhood: Peaks Island. As New England columnist John N. Cole recently stated in an article on "Portland's Island Suburb" (*Down East Magazine*, January 84): "To a visitor standing on the deserted shore, the scene is the quintessential Maine Coast dream," which is " at once Peaks' finest asset and the root of its most pressing dilemma."

As Cole observes, "What's happening now on the 780 acre bit of land, shaped rather like a clam shell, is yet another of several identity swings experienced by the residents in the last half century." The swirling change around Peaks Island has quickened the intensity of discussions by residents and city officials which will establish a direction for the island over the next decade.

The intent of our study was to identify problems and questions as well as put forth recommendations which will help local citizens and decision makers address issues of growth and development. An objective of this study has been to create a realistic vision of what a more sustainable, ecologically balanced community might be like.

History and Development

Peaks Island is a neighborhood of Portland, an easy 3 mile (20 minute) ferry ride from Maine's largest city. However, even with the Portland skyline within view from the ferry wharf and western coastlines, Peaks still retains an almost rural feeling.

The most populated of the Casco Bay Islands, Peaks' year-round resident count of 1200-1500 swells to approximately 5000 during the height of the summer season, and this number is increasing. Many of the summer residents are extending their stays. The low real estate values of a decade ago, combined with the business and cultural renaissance of Portland, have attracted young professionals, artists, writers, and retired people to the island. In addition, many still maintain their livelihood through fishing, as they have for generations. Although fishing remains a testament to the continuity of Peaks' past, the island is not a newcomer to transition.

The earliest people, the Abenakis, were a fishing and farming tribe, skilled in agriculture, fishing, hunting, food preservation, ceramics, and weaponry. The first white settlers came after 1633, and stayed at peace with the Indians. The last record of Indians occupying the island was with the French in 1689, in preparation for attacking Falmouth. Some of the descendents of the early settlers – Brackett, Trott, Woodbury, Parsons, Sterling, Welch, Jones, Trefethen, Scott – are on the island today.

"The last record of Indians occupying the island was with the French in 1689, in preparation for attacking Falmouth."

At the end of the Civil War two regiments each built a large home for their families' use. In 1888, the Fifth Maine building was turned over to the island. It still retains the stained glass which names the Civil War Veterans. The Eighth Maine Building, built with a Louisiana lottery win, is still maintained by the descendents.

Due to ease of steamer travel, theater in the summers between 1887-1920 was very popular, when the winter population of 75 families increased to 2000. One of the first summer stock theaters was the Pavillion, built in 1880. Four years later, the Gem Theatre was built as a skating rink for $24,000, complete with an orchestra and kerosene lamps. Roller skating was the rage for several years. In 1889, the Gem was converted to a theater for $14,000, the first play being "Diplomacy." The Gem continued as a theater and later as a ballroom until it burned down in 1934. Other attractions at the time included the Greenwood Garden Theater, the Peaks Island House, a boarding hotel, tenting,

"Due to ease of steamer travel, theater in the summers between 1887–1920 was very popular, when the winter population of 75 families increased to 2000."

swimming, roller rinks, a shooting gallery, ferris wheel, caged wild animals, and rental boats — a regular fairground. Introduction of the car changed all this, except for a short time during gas rationing associated with WWII, and then again after the renovation of the Greenwood Garden Theater in 1950.

At the decline of the entertainment era, during the depression, the City of Portland moved its poor to the island, a sort of "out of sight, out of mind" approach to poverty. This was followed by WWII, when the military lived on the island and built Battery Steele, a bunker with gun emplacements, on the southeast portion of the island. The battery combined with built sighting towers was supposed to protect Portland harbor and major ship repair facilities. Fortunately, they were never needed, especially considering that the construction was finished *after* the war ended. Their original function is of no value, given today's war machinery. A major fire in 1967 destroyed the remaining barracks.

In 1984, the increase in the attraction of Peaks as a place to live is seen reflected in the real estate values, which are climbing faster than Portland's.

Population

Unlike a majority of the 3500 coastal Maine islands, Peaks Island has experienced a steady increase of year round residents over the last decade. The rate of change has been particularly noticeable since 1980.

The actual number of year round and summer residents remains an enigma due to the somewhat transient nature of the Island's population. The 1980 Census pegs the year round resident

"Roller skating was the rage for several years."

"Energy conservation seems to be part of every citizen's renovation and retrofit strategy."

John Crowley

population at 890. This figure does not account for the large winter rental population.

Population estimates prepared by the Council of Governments (COG) in the spring of 1984 (Table 1, Appendix) based on data collected from island service providers, indicate a winter population of between 1200 and 1500. The summer population is believed to fluctuate between 4500 and 6000. COG predicts that the year round populace will increase to 2000 by 1990, with the summer citizens holding steady at 4500 to 6000.

A comparison of U.S. Census population data (Table 2, Appendix) indicates an increase in the proportion of island residents between the ages of 20 and 45 from 21% of the population in 1970 to 34% in 1980. The population under 45 years of age was 55% of the total in 1970 and had increased to 61% by 1980. In 1980, 23% of the population was over the age of 60, down from 28% in 1970. Continued growth of the 20-45-year-old cohort is expected throughout the decade. It is this group which is most active in converting summer cottages to year round dwellings.

Individual and family income statistics reported to the U.S. Department of Labor Statistics (Table 3, Appendix) by the City of Portland rank the Island neighborhood 12th of 13 on an income scale. The mean family income in 1979 was reported to be $13,171, and 12% of the families were below the poverty level.

Although current data are not available, it is believed that the mean island family income has increased measurably during the last five years. At the same time, the proportion of families living below the poverty level has probably decreased slightly.

Settlement Pattern and Housing Stock

Peaks Island's footprint resembles a large clam shell measuring approximately 1.57 miles along the north-south axis and just a mile along the east-west axis. Existing development is concentrated along the western and southern edge facing the Portland Peninsula and Cape Elizabeth.

Importantly, the revival and development of the Island Avenue business zone is in keeping with the community's historical settlement pattern. This district clearly has an observable focal point, somewhat linear in nature, which has concentrated commercial activity along one portion of the spine connecting the island's historically important neighborhoods.

Although commercial construction is occurring, residential building comprises the majority of construction activity on the island. House additions, renovations, and conversions of summer to year-round dwellings very much outnumber new housing starts. Eighty four percent of the island's housing stock was constructed prior to 1939. (Table 4, Appendix, presents a profile of the housing stock and ownership for all of the city islands.) During the last two years, no more than ten new houses have been built. Most of these new buildings have been built on shorefront lots located on the island's east side, locally referred to as the Backshore.

The total value of construction put in place, based on city building department permit data, was $352,842 in 1983, a 56% increase over 1982 (Table 10, Appendix). The center and the east side, comprising more than 50% of the island's land area, remain either undeveloped or, as with the Backshore zone, sparsely developed.

John Crowley

This is due to three principal factors: 1) distance from the ferry landing; 2) use as a military reservation during World War II; and 3) the existence of a number of large parcels (ranging in size from 5 to 10 acres) which have been assembled by private individuals.

The location of the ferry landings, both past and present, is the most important variable in determining the settlement pattern. The result is a clearly observable clustering pattern. Island Avenue, extending in two directions from the island's only remaining ferry port (Forest City landing), forms the principal vehicular and pedestrian spine, and links the historically significant nodes located at City Point, Trefethen Landing, and Pumpkin Knob to the north and the community surrounding the Fifth Maine Regiment Building to the south. Trefethen Landing was serviced by the Casco Bay ferry until 1976, when the docking facility was destroyed by a hurricane.

Today, the business zone surrounding Trefethen is predominately residential with the recent 1982 conversion of Webber Store to a private residence. The Trefethen-Evergreen Improvement Association is the only remaining vestige of a civic or commercial use in this area of the island. A recently released Island Rezoning Proposal recommends that this historically important node maintain its business zone classification.

During the past four years, the island business zone, extending from a point just south of Forest City landing to the intersection of Island Avenue and Luther Street, has experienced significant growth. A majority of this buildup has occurred adjacent to the ferry landing itself.

John Crowley

Three restaurants, a private dock facility, real estate office, lumber yard, and gift shop have opened during the past 24 months within 50 yards of the intersection of Island Avenue and Welch Street. In addition, since 1980: a new general store and post office have been constructed; the community center and library have been completed; a hardware store has been converted into an inn; and the island's only major general contractor has expanded significantly.

Tables 6,7,8 in the Appendix give a summary of normal conditions over the year, and by month. Data can be expected to be reasonably accurate for Peaks, although wind speeds will be somewhat higher, days of heavy fog more numerous, and, therefore, percent of possible sunshine less than these figures assembled at the Portland City Bureau.

Vegetation and Geology

Peaks Island is predominantly wooded with intermittent open spaces occurring along the northwest edge and eastern quadrant. These open spaces are a mixture of meadow-like fields and fresh water marshes.

The island's wooded areas are a mixture of deciduous and coniferous species. A more mature, densely wooded area exists to the north, whereas the south and east is comprised of a younger stand of trees, very much in a secessionary growth period. The younger growth in this section (the area described by the boundaries of the military reservation) is due to a major fire which swept the reservation in 1967.

The geology of Peaks Island is quite diverse. Various types of deposits were laid down during the Pleistocene glaciation period. This, coupled

with the geological activities caused by wind and wave action along the shoreline has created a rich and varied geological environment. The west side of the island is made up of steep clay and sand embankments interspersed with sand beaches and outcroppings of bedrock. The northern tip, east and west coastlines are almost fully characterized by weathered, upturned, and fractured sedimentary and metamorphic rock formations. One notable exception to this characterization is a fine grained sand beach which has formed on the south side. It may be attributed to deposits caused by the rapid tidal currents between Peaks and Cushing Islands.

After the dispositions of the Military Reservation at public auction by the Defense Department in 1958, a number of land transactions occurred, having a few notable results: a number of 1-acre lots along the Backshore have been parceled out and sold to private citizens and local companies; a few interior parcels were designated and later sold to private groups; a 100-acre protected open space area was formed and is now under jurisdiction of the city of Portland; a 14-acre parcel, site of the Battery Steele fortification, is now owned by the Star Foundation, a nonprofit education and research organization; and a 20-acre parcel is under the management of the State of Maine Wildlife and Fisheries Department. Hence, approximately 140 acres (18% of the island's land area) are either already protected or proposed to be protected open space. The future disposition of the balance of the island's undeveloped land, roughly 200 acres, remains a key issue which bears directly on the island's character, need for additional infrastructure, and long term environmental quality.

Climate

In general, the climate is moderated by the proximity of the ocean. Spring comes very late, and is soon followed by a temperate summer during which few nights are too warm and humid for comfortable sleep. Fall lasts late into the year with many sunny days. Winter, when it comes, is severe and long, but is punctuated by frequent thaws. The lowest temperatures are usually accompanied by light winds. Precipitation is distributed almost uniformly over the year. Heavy seasonal snow accumulation, over 100 inches, occurs about one year in ten. Blizzards are rare, as the White Mountains to the northwest shelter the Portland area. Winds are generally moderate, with high winds usually during March and November. Days of heavy fog are more numerous than in Portland.

Immediately adjacent to the rugged rockbound shoreline is a labyrinth of small basins which capture the island's surface water before depositing it into the ocean. The basins which extend intermittently along the entire east side of the island form a network of fresh water ponds and marshes. Much of the eroding soil being carried from the higher island elevations is deposited in these basins, ponds and marshes. Hence, vegetation and wildlife are abundant within this unique ecosystem. Like the majority of Maine Islands, the bulk of Peaks' land area is characterized by thin soils and a preponderance of exposed bedrock, similar in nature to that which is found at the coastal edge.

Transportation

With the exception of a few private motor launches and a costly ($18.00 each way) water taxi, the citizen-owned Casco Bay Island Transit

Leslie Horst

District (CBITD) provides the only reliable, economical transportation to island residents and vehicles. Ferry service between Portland's waterfront and Peaks Island, 3½ miles away, runs regularly (year round) and caters predominantly to those who work a 9-5 job in downtown Portland. The summer schedule provides almost hourly service beginning at 6:15 a.m. and terminating with the last departure from Portland at 11:15 in the evening. The winter schedule is similar but with a large gap in the late morning and early afternoon.

Until early 1981 the Casco Bay lines (CBL) was privately owned and did not cater to residents as much as to the summer tourist traffic. Due to poor management the CBL filed for bankruptcy in 1981 and was held in receivership until March 1982 when the CBITD formally took control of this vital service.

Energy

Today, energy for space heating, cooking, heating hot water, lights, appliances, and vehicles is almost entirely imported from the mainland. Although there are no data on the percentage of space heating and hot water heating derived from solar energy or island grown timber, 10% is probably an optimistic estimate.

A notable number of passive solar home additions and greenhouses exist on the island, as well as a number of solar hot water systems. Energy conservation seems to be part of every citizen's renovation and retrofit strategy. Of course, this ethic is not without historical precedent in the islands of Maine.

The predominant fuel source for space heating is #2 fuel oil, followed by wood, electricity, and

Leslie Horst

"The location of the ferry landings, both past and present, is the most important variable in determining the settlement pattern."

"An underlying premise was the acknowledgement that Peaks Island is now and will continue to be deeply integrated into the urban fabric of Portland."

"The origin of Peaks' as well as Portland's water supply is Sebago Lake, 30 miles west of the city."

bottled propane gas, in that order. Electricity is used as a primary means of space heating in less than 10% of the island's housing stock. Fuel oil, gasoline, and propane are distributed by two local vendors, and prices run 10% higher than on the mainland. Cordwood is trucked to the island by a number of vendors. Cooperative bulk purchasing is a common practice, with hope of saving a few dollars. Firewood prices range from $100-130 per cord. The use of firewood for space heating is probably greater than in the city. It is estimated that in excess of 50% of the island residents supplement a sizable portion of their heating needs with firewood. Electricity is provided to the island through a cable buried beneath the ocean floor. The cable was installed in 1943 and the current capacity is 750 KVA. The cost of replacement of the cable from Long Island to Peaks is estimated at $100,000. Central Maine power (CMP) estimates that replacement will be required in 50 years from 1943 – within a decade from now.

In addition, a small 3 mw diesel fueled power generation station is located at City Point. The facility is owned by CMP and is used solely to offset New England Power Grid peak demands in the event of a power failure. The unit is not used to supply power directly to the island community. The power plant is located on Cousins Island, with the cable running from there to Chebeague Island, to Long Island, and then to Peaks Island.

Food

In excess of 90% of the island's food requirements are met through imports from Portland. All imported food is transported via the Casco Bay Island Transit District. A majority of year round residents have vegetable gardens. Neither the total area being gardened nor the value of these locally produced crops is known; however, almost all gardens are less than 50′ x 50′, or 1/5 of an acre.

Water

Approximately 50% of the island's water is provided by the Portland Municipal Water District; 450 homes (50%) have municipal water hookup. Water is piped beneath the bay from Portland. The 8″ water main which services the islands was replaced in 1976 and has an estimated life of 30 years. The origin of Peaks' as well as Portland's water supply is Sebago Lake, 30 miles west of the city. Households which are not served by the Municipal Water System have drilled or dug wells to fullfill their water requirements. Peaks Island residents used 117.6 million gallons of water in 1983.

Sewage/Liquid Waste

Approximately 50% of the island's buildings are serviced by a municipal sewage disposal system. No treatment is provided. Island sewage disposal is simply a pipe extending from building, to street, to one of two overboard discharge pipes. No treatment facility is planned, although at least one major study of liquid waste disposal has been undertaken by the City of Portland. The buildings not serviced by the municipal sewer either use a cesspool, which must be pumped out periodically, or a septic tank and leaching field. For those residents with a cesspool system a local contractor will pump the tank for a modest fee. The sludge is then discarded in a septage disposal area located near the baseball field, at the center of the island; this facility is "approved" and monitored by the

"A paramount dimension of community sustainability is a renewal of local action and decision making."

Leslie Horst

Department of Environmental Protection.

Existing Solid Waste Disposal Systems
The city's Peaks Island landfill has limited remaining space and no suitable sources of cover material. Therefore, city crews remove Peaks Island wastes to the mainland whenever possible, while simultaneously operating the landfill for Island residents.

Two city packers are used to collect island residents' solid wastes. When the tide is right for the city's M boat to land on the privately owned landing used by the city, or when the CBITD can accommodate the packer, these trucks are taken to the mainland to discharge their wastes. When transportation to the mainland is not feasible, the wastes are put into the Peaks Island landfill.

Despite the small population served, two packers are required because of the difficulty involved in pick-up and because of the delays involved in transportation. Typically, packers are sent to the mainland without a driver. City personnel meet the packer at the Mainland landing to take the packer to the RWS baler, wash it, repair it and send it back to the island. In the meantime, the island crew is picking up the remainder of the island's wastes with the second packer. When that is full, it is sent to the mainland while the first packer is returned empty. As many as three trips each week may be required to handle the wastes transported to the RWS baler/balafill system. In addition to the above, collection occurs with a city pick-up truck and driver for those areas not accessible to the packer. This pick-up requires a four wheel drive vehicle to gain access to some of the small ways and lanes where city collection is provided. Wastes collected in the pick-up are then loaded into the packer for transportation off-island where possible.

The Key Elements in the Island's Future
As the concept of "sustainable design" implies, the group studying Peaks Island chose to examine opportunities which could increase this island community's level of resource and economic self-reliance. An underlying premise was the acknowledgement that Peaks Island is now and will continue to be deeply integrated into the urban fabric of Portland. In light of current problems facing the island community, those who studied Peaks Island chose to focus on issues which could, in the near future, assist citizens and policy makers to more fully understand the dimensions of the problems facing the community. The goal was to develop a series of visual and written images of what the community might be like if a realistic "sustainable design" decision path were selected. A second, equally important premise adopted by the group was the belief that sustainable design in the physical sense is inextricably linked to the economic life of the community. It then follows, as stated by Jane Jacobs in her book *Cities and the Wealth of Nations*, that "Economic life develops by grace of innovating; it expands by grace of import replacing. Furthermore, successful import replacing often entails adaptations in design, materials, or methods of production, and those require innovation and improvisation." Hence, an exploration of the potential local economic opportunities which might be contained in a solution equation for the island's key problem areas was a natural prelude to the study of physical form.

A paramount dimension of community sustainability is a renewal of local action and decision making. Defining critical issues which have implications for the future social and physical character of the community and need immediate attention is an effective approach to helping individuals understand that they can really influence the discussions which affect daily life. Of course, a community organization which provides strong leadership and direction is an essential element to the implementation of local initiatives and decisions.

Based on these ideas and our analyses of collected data and field observations regarding the island's existing built and natural environment, the group defined critical problems and issues to which design and planning recommendations would be addressed. Although many more questions were raised than could be studied in the short three day session, it was hoped that questions, as well as ideas and recommendations, would be useful for future planning. The amenities which contribute to the special quality of the island have also been outlined, as it is this quality that the people of Peaks Island hope to maintain as the tides of change swirl around Casco Bay.

Problems, Issues, and Questions

Population Growth, resulting in an increase in the number of dwellings and commercial buildings along with a need for improved services, is inevitable. Zoning policies that respect the delicate island ecosystem are essential to maintaining the present physical character. Questions arise with respect to: a reasonable maximum sustainable population; density of population; type of development; open space and conserva-

"Conservation of energy, defined by our group as an energy resource, is wisely used, but its full economic potential has not yet been exploited."

tion easements; and change of character.

Solid and Liquid Waste Management and Disposal are two issues now reaching a critical level, as acknowledged by the Department of Environmental Protection (DEP), city government, and local residents. Future options, with their associated benefits and liabilities, must be assessed.

Tourism on Peaks Island, because of easy access to Portland, is increasing significantly. The need to accommodate day visitors must be assessed. Should the day visitor be encouraged to enjoy the island's scenic beauty? If yes, what services must be provided? What management and control issues must be addressed? What benefits accrue to the island's local economy from day visitors? Are they worth the cost to maintain? Who should bear this cost?

Energy requirements are met predominantly through sources imported from the mainland, except for a modest amount of solar energy and local firewood. Conservation of energy, defined by our group as an energy resource, is wisely used, but its full economic potential has not yet been exploited. What opportunities exist for further development and exploitation of locally derived energy sources? Solar (active, passive and PV), biomass, and wind energy production and utilization must be evaluated from an economic, social and political perspective.

For example, is it realistic or practical to consider intensive forest management practices on Peaks Island's large undeveloped land tracts? How much wood could be harvested, while maintaining a productive, healthy stand of trees? What employment opportunities would result?

As previously noted, **food production** on the island is minimal. A thought of island agricultural self-sufficiency is wildly impractical. But in light of the objective to examine local economic development prospects, what agriculture-based opportunities might be plausible, given the island's close proximity to the Portland marketplace? Building on Jane Jacobs' hypothesis pertaining to import replacement, entrepreneurism and improvisation, how might the island's undeveloped land area be used to the island's economic benefit, in keeping with our definition of sustainability?

As outlined in the Existing Conditions section, the Island Municipal Water System is in good repair, has ample capacity and the supply appears plentiful. However, **water supply** contamination and shortages are beginning to seriously hamper development and the quality of life in many parts of the U.S., including the northeast, and numerous environmental groups are predicting water to be a major resource problem in this region before the end of the century. Peaks, which relies on drilled and dug wells for 50% of its fresh water, should be mindful of the results of excessive aquatic depletion and the need for conservation of this treasured but often taken for granted resource. Questions regarding aquatic draw-down and recharge rates should be studied. The long term reliability of Sebago Lake as a source for clean, plentiful, safe water should be established, and water conservation measures should be considered for both municipal and well supplied water.

A lack of local (island) employment opportunity is a problem for many island residents, especially women with young children, who prefer to remain on the island. Although excellent child daycare facilities exist on the island, coordinating off island employment and daycare schedules can be very difficult. Hence, local employment appears desirable, and potential opportunities should be characterized. Both benefits and liabilities should be assessed.

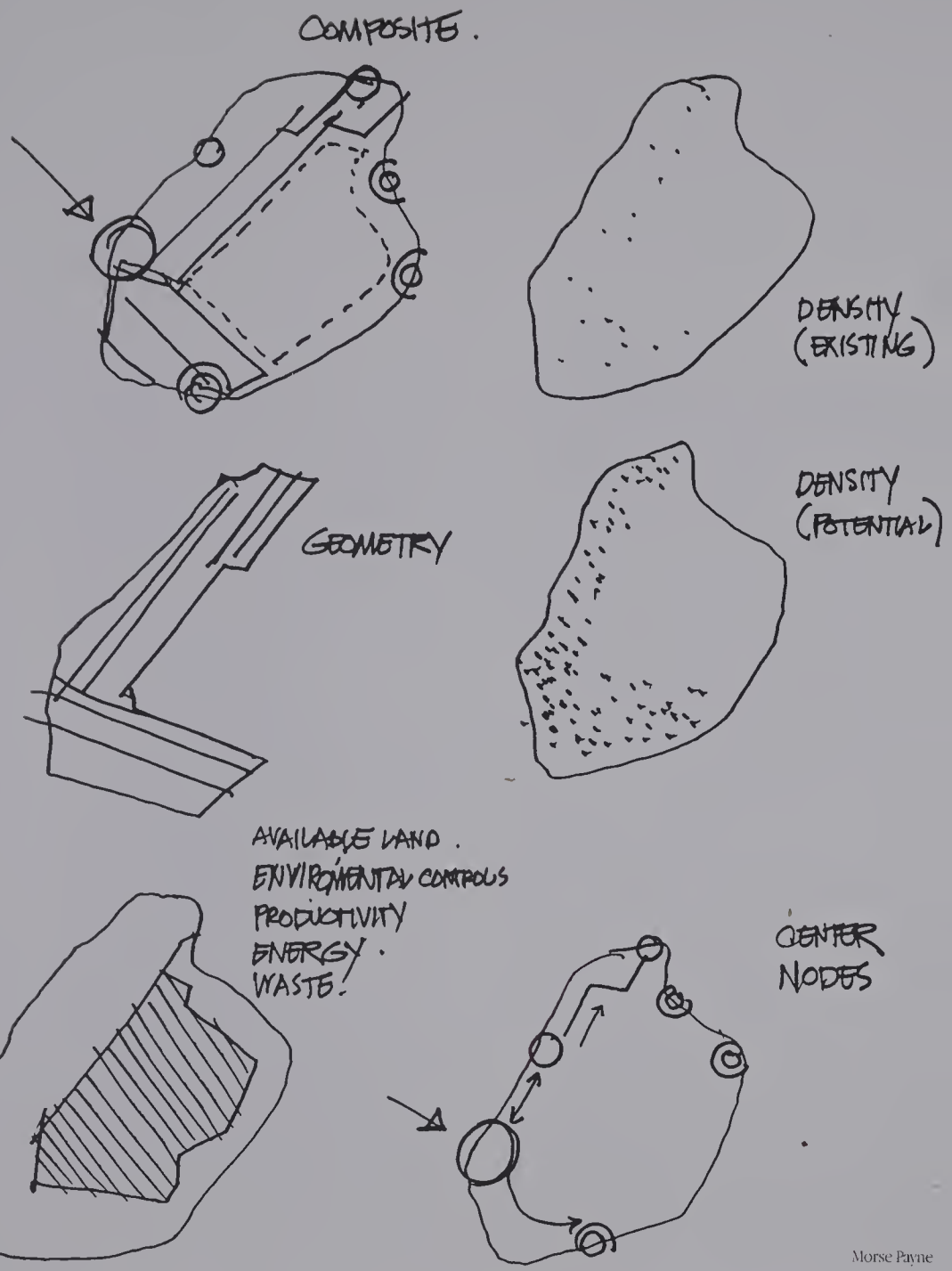
Amenities

For those who live on the island year round, or only in the summer months, Peaks has a special, almost magical quality. Its rural atmosphere and scenic landscape is a welcome contrast to the stone, concrete, and glass dominated fabric of urban Portland. The island amenities are captured by a few simple words and phrases which need little further explanation:

natural beauty
authenticity
rural environment
strong sense of community
isolation and solitude – quiet
summer people
connection to the more rural islands of the bay
weathered rockbound coastline
sea bound beaches, marshes and first paths

"... numerous environmental groups are predicting water to be a major resource problem in this region before the end of the century."

"... sustainable systems such as greenhouse food growing and waste disposal, can best support the summer population. The two can work together, with the all-year residents profiting from the tourist industry."



Morse Payne

A Master Plan For Peaks Island

Morse Payne and Sarah P. Harkness

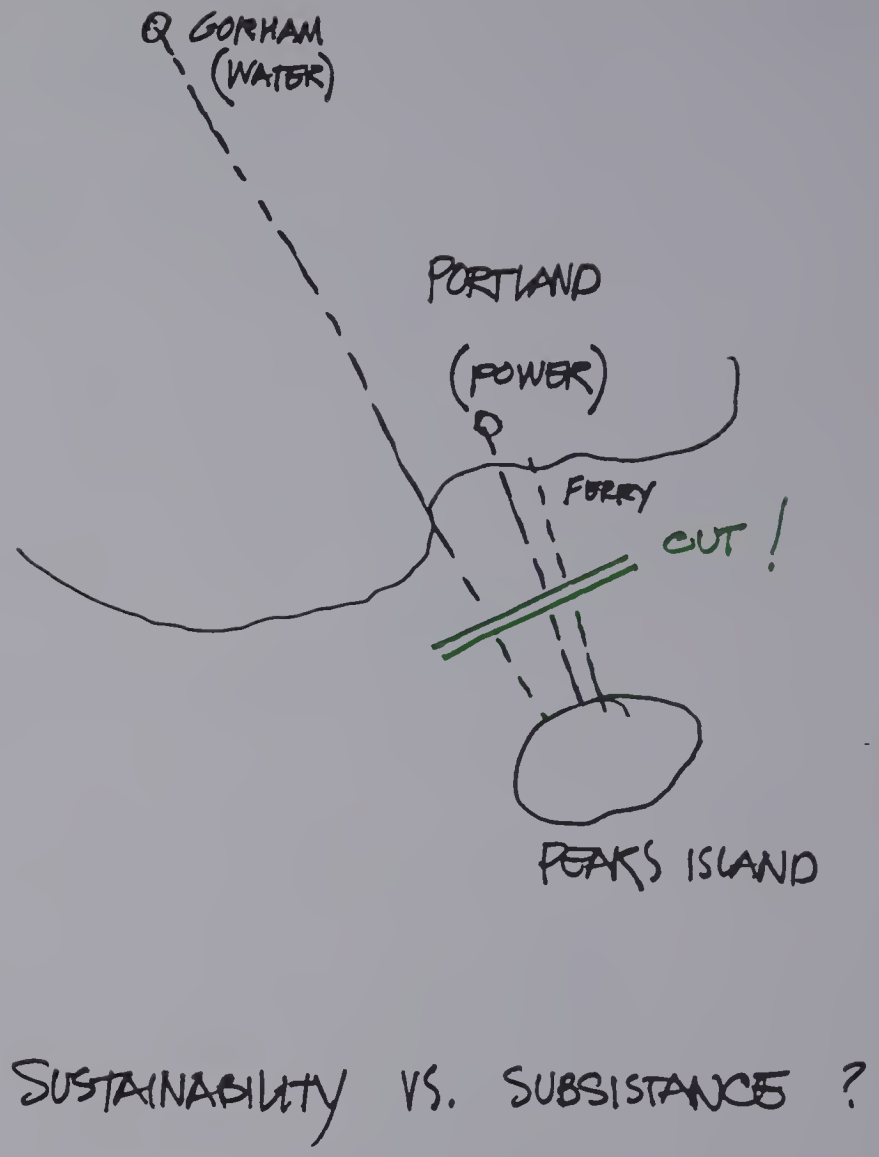
The issue of sustainability brings a rearrangement of priorities to the master planning process. As Gordon Tully says, sustainability means that if you can do something locally, do it that way; if a small way works as well as a big way, do it the small way. For a study in self-sufficiency, a small island such as Peaks, neatly limited by its shores, would appear to be an ideal subject. Although Peaks Island is attached to Portland by a 20 minute ferry ride and to the mainland by pipelines for water and power, what if the connections break? What if Goreham, Maine, 30 miles inland, needs to use all of its water supply instead of exporting water to Peaks? Peaks Island, although attached to Portland and the mainland, does have its own water supply in the form of wells, its own small (diesel oil) power plant, and a considerable portion of open land to use for agriculture, forestry, and recycling of wastes. Much as we would like to think of the island as a self-sufficient boat, none of these systems is adequate to provide total self-sufficiency. However, a master plan should protect, enhance and add to the sustainable features that do exist.

In developing a master plan for an island based on sustainability, one would like to find solutions that would be intrinsic to the island situation. For energy, wind and tides come to mind. For food production, one thinks of seafood, either from the rocky shores or from the open sea. These considerations did not, however, greatly affect the master plan. Energy from any local source, such as wind or tide, could be fed into the existing Peaks Island grid, and therefore would not need specific planning. Fishing, lobstering and boating are, surprisingly, not active or remunerative pursuits from Peaks Island. The subject that did occupy much thought and discussion in the group, and which is intrinsic to the inhabited island situation, was waste disposal. Many opportunities were seen in this area, and were incorporated in the agricultural section of the masterplan.

The masterplan as a whole dropped into place very naturally. Morse Payne, who developed the plan, described it as a "soft exercise" that worked. In examining the maps of the island that showed streets, lot lines, existing buildings, contours, land conditions and ferry lines, Morse determined that there was a geometry that already exists, and it makes sense.

Building on this geometry and further defining it, it was logical to say that the west and south edges of the island, which are already the most built up, could afford greater density. This is the area that faces Portland, is more protected from ocean storms, and relates to the ferry with easy walking distances. A small amount of undefined commercial activity has grown around the ferry landing: a restaurant, gift shop, post office, grocery store, hairdresser and lumber company, each very small, catch people as they come and go on the ferry; cars and taxis line up with the comings and goings of the ferry. Since this is where the action is – social as well as commercial – a town center could be more deliberately developed. Other nodes along the west and south coasts could focus on larger buildings such as a clubhouse or inn.

A Convention Center was considered. The island's location, easy accessibility and romantic character would seem to be suitable. It didn't take much thought to realize that a typical con-



Morse Payne

FERRY ROUTE
TO PORTLAND
Summer

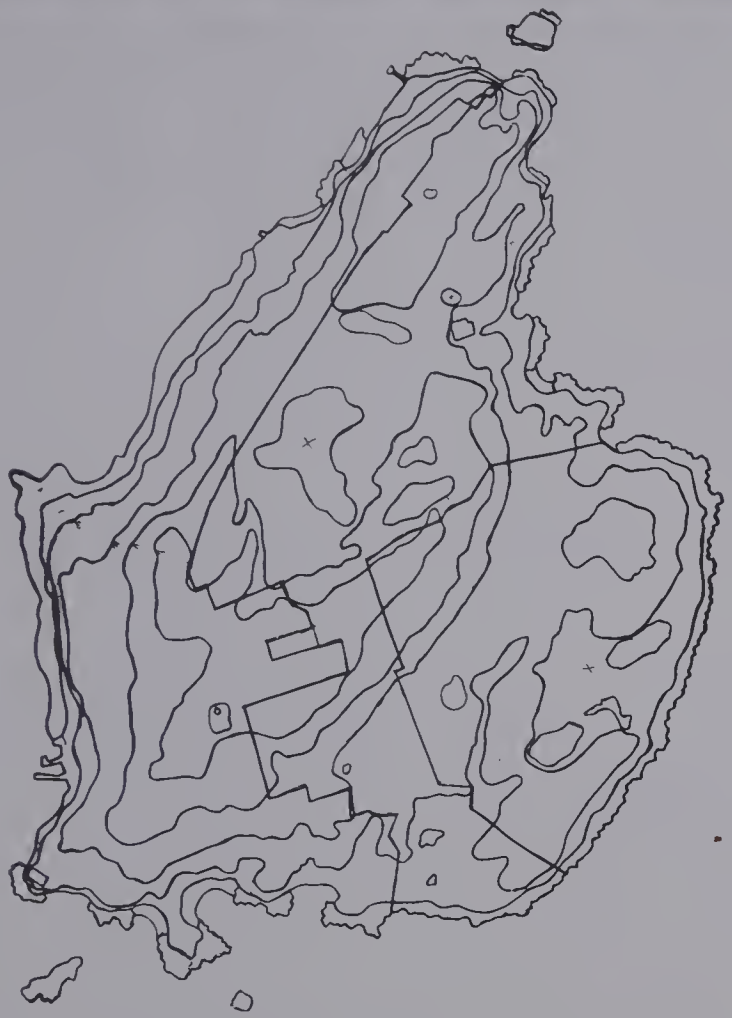
vention center would be out of scale; residents would be outnumbered and the developing autonomy of the island lost. For small conferences or retreats, however, Peaks Island is ideal, (as we ourselves experienced in our Design-In.) The island might very well afford more facilities for meetings and transient housing, without losing the character of the island. Within the west/south edge strip would be the most desirable location, as the proximity to the ferry makes it unnecessary for conferees to bring cars onto the island; the island taxi service should suffice for people and luggage.

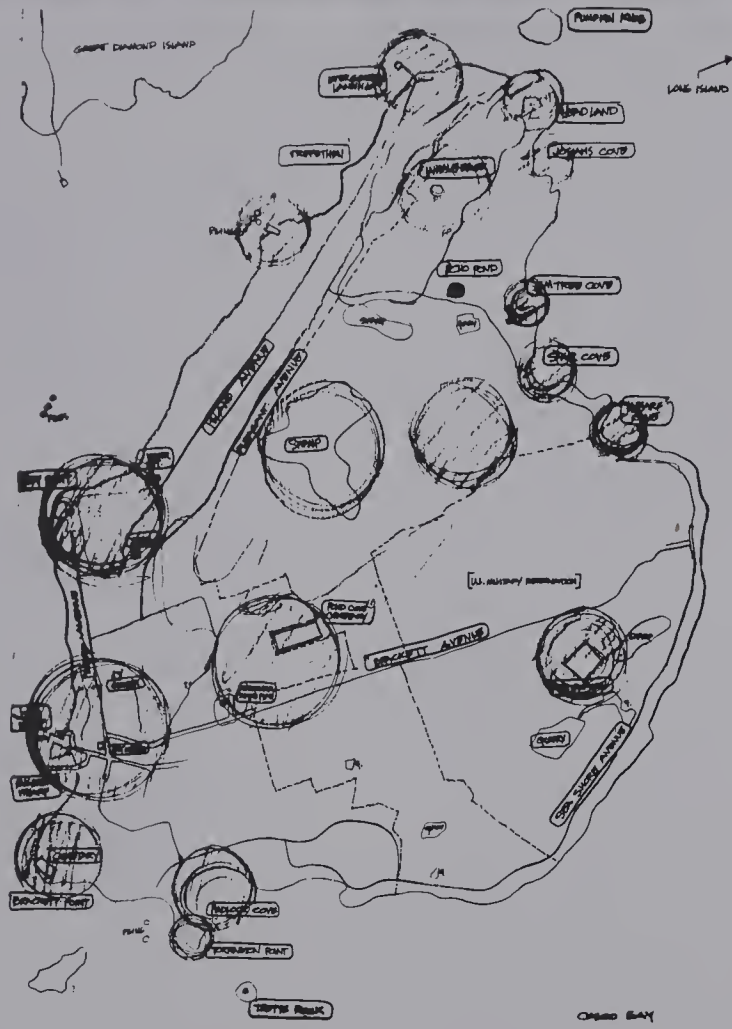
The west/south edge of the island has a distinct drop towards the water; houses on the lower side of the street are often reached with a bridge leading to the porch entrance, while houses on the upper side usually have a flight of steps leading to the porch. This difference of grade allows views to the water and a feeling of light and space for all the houses, even when they are quite close together. This led Morse to think that even if all the lots shown on the map were built upon, which would about double the number of houses, one would hardly know the difference. Everyone loves the island as it is, but we felt that further density, if thoughtfully zoned, would not be harmful. A look at an 1800s print that shows the island in its heyday reinforces that opinion.

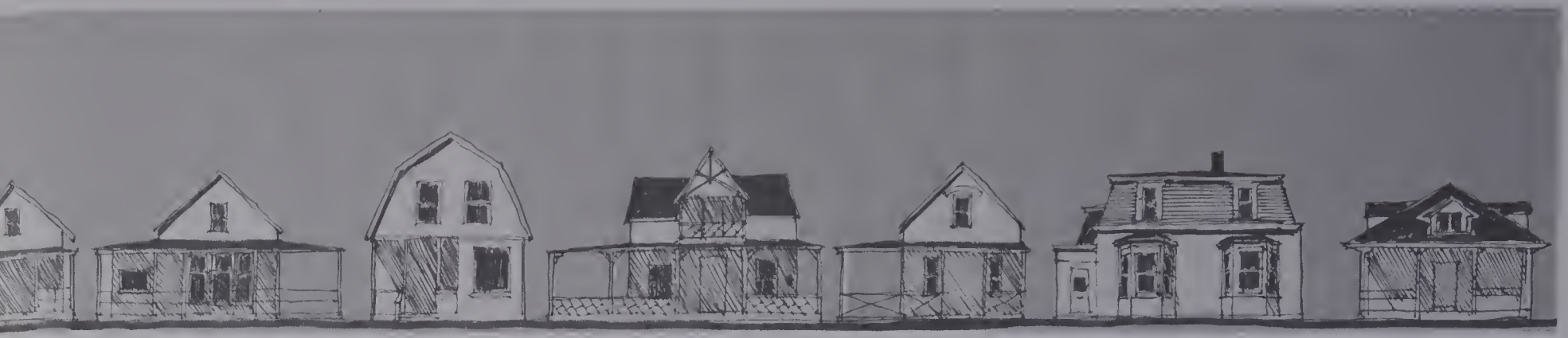
The built-up west/south edge of the island has an almost distinct inner edge as well. This leaves the remarkable situation of a large inner portion of the island, reaching to the east coast in many places, that includes forest, meadowland, marshes and rocky coast. Within this area is the 600 foot long Battery Steele and a sprinkling of gun turrets left over from World War II.

Morse Payne

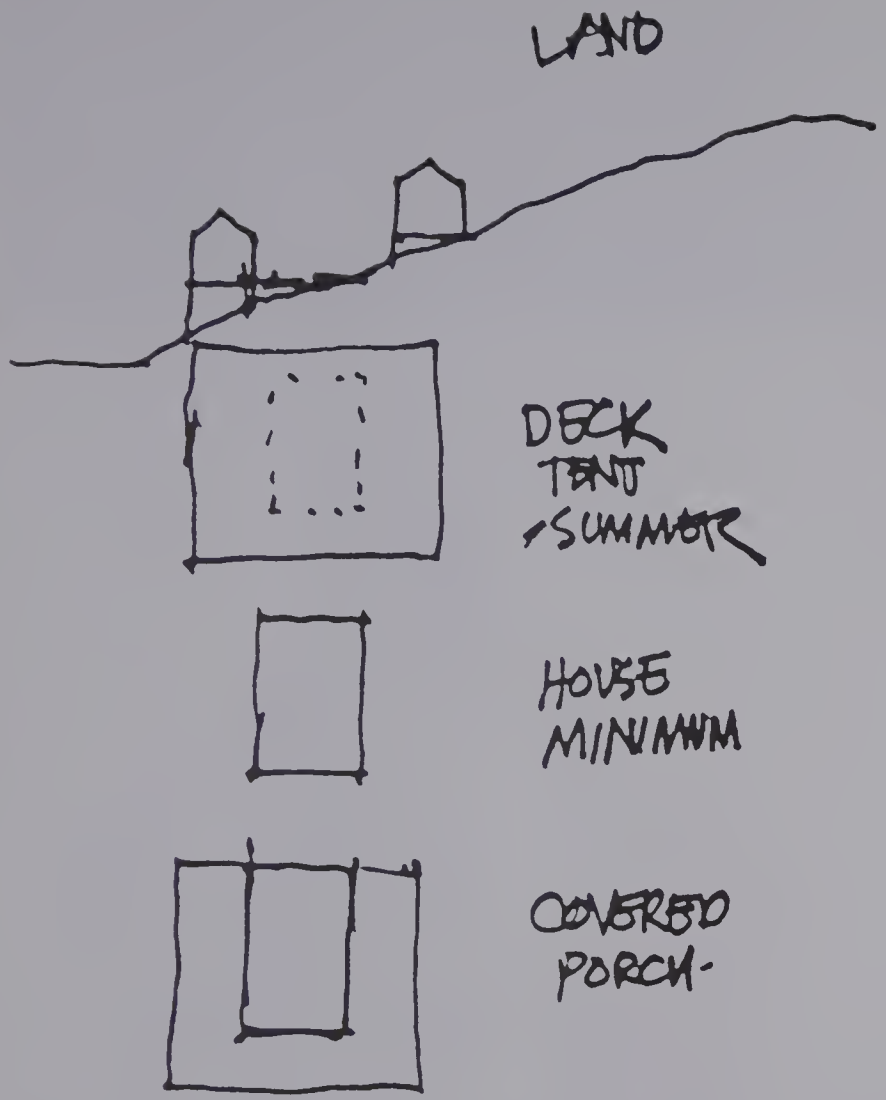
"Peaks Island reflects the need of a group of people to be somewhat isolated (mostly by choice), close to Portland and yet confined by topography for a strong sense of identity."




GREAT DIMOND ISLAND
LONG ISLAND
PUMPKIN MARSH
HERD LAND
WIGWAMS COVE
ROAD POND
SWAMP
BRACKETT AVENUE
QUARRY
INDIGO COVE
INDIGO POINT
BRACKETT POINT
CRESCENT BEACH



Morse Payne



Morse Payne

"The ferry terminal is a natural focus where all visitors and residents will converge."

A more ideal area for small scale agriculture and sustainable systems such as wind power generation and recycling of wastes could hardly be imagined. (The STAR Foundation has already made a start with its programs for young people, who learn such things as how to grow vegetables and build solar greenhouses.) Morse's abstract sketches of a master plan for the island indicate where the demarcation occurs between developed west/south edge and the inner agricultural area. Zoning could formalize the line and preserve this remarkable combination of land uses.

Recently a few houses have been built on the east coast, looking out over the Atlantic Ocean. A sprinkling of houses probably for summer people, with two or three nodes or centers of interest along the shore would not hurt the master plan. However, zoning should not allow dense development in this area.

An increase in the number of year-round residents on Peaks Island would lead to greater political autonomy for the island, rather than domination by the city of Portland. On the other hand, sustainable systems such as greenhouse food growing and waste disposal, can best support the population in the summer. Summer and all-year residents can work together, with the all-year residents profiting from the tourist industry.

The typical Peaks Island house has a very special character. Legend has it that the early summer visitors built platforms for tents. The tent became a house and the platform a porch. Recently many of the porches have been closed in by the all-year residents. From a design point of view, closing in the porch destroys the character of these typical houses. As the all-year population increases, we would hope to see a more all-weather style come into being, and hope also that the characteristic style will continue for summer residents.

Leslie Horst

PEAKS ISLAND TOWN CENTER

Claude E. Menders

Town centers have provided a focus for community activities since the formation of cities. On a small island, the concept of sustainability can be integrated into a town center to become a unique statement which reflects a way of life. A town center can become a forum for practical interchange and social interaction.

Island life, due to the restricted land mass, creates its own scale. Streets are narrow, with numerous houses built on 1/4 acre or less. Neighbors and commercial establishments are all within walking distance. This is in contrast to the communities on the mainland where the scale is dictated by modes of transportation with divided highways or streets. Town centers on the mainland can often be perceived as individual buildings versus a grouping of buildings. The agora as a community center is romanticized, but seldom present. Peaks Island reflects the need of a group of people to be somewhat isolated (mostly by choice), close to Portland and yet confined by topography for a strong sense of identity. There is also a common theme of a community life "as in the days gone by." Whether this truly exists or is largely imagined is probably irrelevant, as images and aspirations often overrule pragmatic reality; however, the case for the development of agora as community center remains strong.

Sustainability, which is valued primarily for its economic virtues, should also have social benefits. The premise can be that self-reliance, reduction of waste, and preservation of our limited natural resources bring us into greater harmony with our physical world, and hence, will also enrich our emotional health.

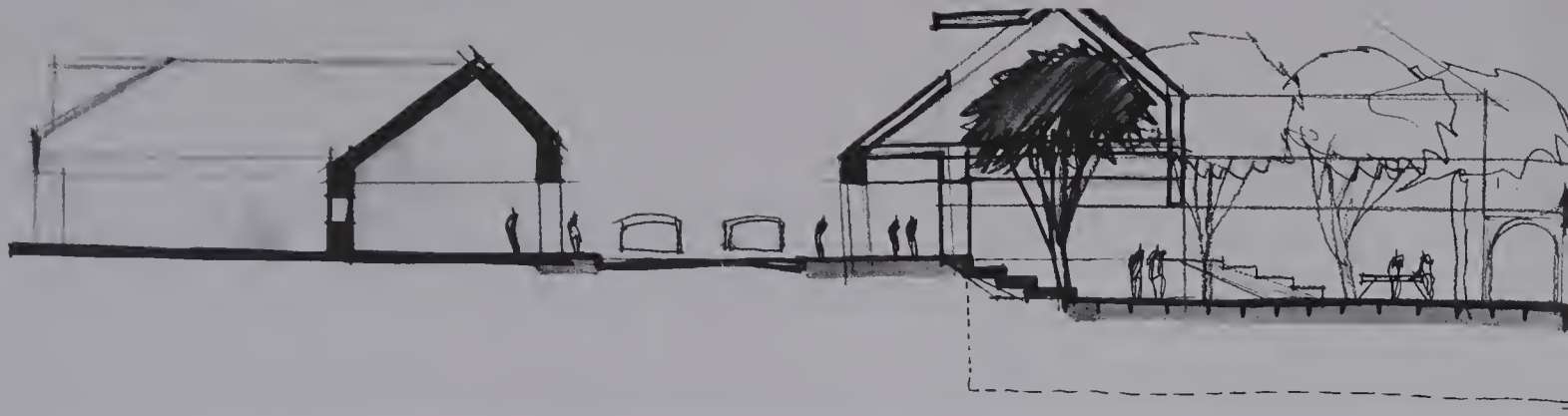
The ferry terminal is a natural focus where all visitors and residents will converge. Visually it is a place of great impact as a point of transition between water and land. We are apt to recall our first landing (whether by sea or air) on any island with memories that include the weather and many inconsequential details that under other conditions might not be remembered. Hence, incorporating through events and architecture a community town center at or near the ferry terminal makes good sense.

An early study of the site surrounding the ferry terminal indicated the density of the open space versus the built areas. A large parcel of land adjacent to the ferry terminal at the corner of Island Avenue and Welch Streets is publicly owned and currently undeveloped and used as a parking lot. Although other properties were evaluated, selecting a vacant, publicly owned property would certainly facilitate the execution of any master plan. Some commercial activity has grown around the landing: a restaurant, post office, gift shop, lumber company and grocery store. A town center would reinforce this continued growth and become a forum which would symbolize the sustainability of the island.

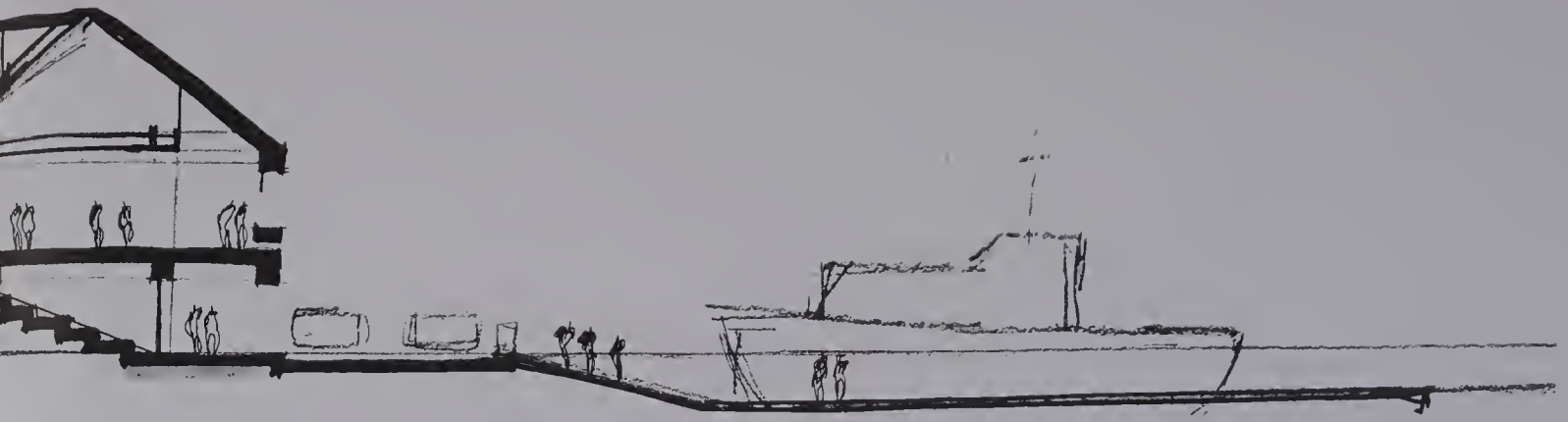
The town center can be translated into diverse functions. It can include a farmer's market, a school on sustainability for the recycling of waste and the management of resources, a small museum, a post office, and a town hall with a meeting hall and a day-care center. These functions are grouped into an "L" shaped building which encloses a tree lined plaza with a sunny southern orientation. The plaza is the gateway to the ferry terminal.

The farmer's market is a showplace for agricultural goods produced from greenhouses and

Jacek Von Henneberg



Leslie Horst



the recycling of waste products, and would symbolize the character of the island. The day-care center, along with other social functions, would bring the parents and the rest of the community (including the commuters to Portland) together on a daily basis.

Automobiles, which normally demand the most desirable real estate properties and large areas of bituminous paving, are located on one side of the landing at a lower elevation with a separate access road around the town center. Since the grade drops rapidly towards the ferry landing, the automobiles would be in their proper place: out of sight below the town center. At this lower level, shops for the rental of bicycles, scooters, golf carts or other small motorized vehicles would offer an alternative mode of transportation and retain the island scale between buildings and streetscape.

Such a town center would affect all persons coming and going to Peaks Island and become their community center. Sustainability would weave itself into their daily life. One would like to believe that it would also enrich the emotional and spiritual lives of the people of Peaks Island.

". . . perhaps the most fundamental energy end use implicit in island living is that used for ferry and marine transport."

"... it was felt that sustainable design concepts applied to energy should not be based on a strict 'cutting of the cord' from the mainland."

Energy Issues for Maine Islands:

Applications to Peaks

Scott A. Noll

Energy, in its many diverse forms, is an essential building block of every community. The dependence of particular communities on the energy supply infrastructure becomes especially pronounced in the case of discrete geographic entities such as islands. With border lines clearly established, islands provide an interesting opportunity to test the concepts of sustainability as with the Peaks Island and Vinalhaven Design-In exercise.

The degree to which an island community can become energy self-reliant depends upon the energy end use needs of its populace, the availability of energy resources to meet those needs, and the long term economic viability of replacing or substituting imported energy with island based energy supplies and efficiency improvements. However, even when island energy self-reliance may be technically feasible, it may not be warranted from an overall social perspective because of greater efficiencies obtained from integrating with the mainland regional energy infrastructure.

Within the Peaks Island team, it was felt that sustainable design concepts applied to energy should not be based on a strict "cutting of the cord" from the mainland. The validity of this conclusion becomes quite apparent when one considers the physical attributes of Peaks Island, the existing degree of integration with Portland, the energy infrastructure of Maine, and the limitations to extensive energy import substitution, especially with liquid fuels and electricity.

This section of the Peaks Island design team analysis sets forth a discussion of the energy component of the design exercise. Included are subsections on existing energy end use patterns, the energy supply infrastructure, and opportunities for a sustainable energy future through conservation and efficiency improvements, use of island energy resources, and further development of the region's renewable energy resources.

Existing Energy End Use Patterns

The existing energy demand profile of Peaks Island is determined almost entirely by its largely single family detached residential and open space land use pattern. With virtually no heavy commercial or industrial establishments on the Island, energy use is diffused rather than concentrated; energy densities are low; and the household and transport sectors account for the great majority of energy end uses. Table 1 summarizes the energy end uses and the energy resources supplied to meet the end uses.

To a large extent, Peaks Island residents import most of their material requirements from the mainland. Aside from the few residents who provide their business services on or from the island, most residents "export" their labor through jobs held on the mainland. Thus, labor export generates income to pay for material imports. As with any island not connected to the mainland by causeway, ferries and other marine transport provide the vital link for the exchange of people, supplies, food, liquid/gaseous fuels, and vehicles.

Therefore, perhaps the most fundamental energy end use implicit in island living is that which is used for ferry and marine transport. Diesel fuel, derived from petroleum imports to East Coast refineries, is the exclusive energy source to the marine transport sector. As summer and year-round population increases on Peaks Island, passenger and vehicle traffic will increase. Because diesel energy use is relatively insensitive to passenger ridership compared to number of round trips, if ridership increases with currently scheduled ferry frequencies, there need not be a large increase in ferry diesel fuel use in future years. However, should population pressures result in more frequent passenger and vehicle ferry transport, especially during the winter months, more diesel fuel use will be required.

Vehicle use on Peaks Island is essentially limited by virtue of need. Given that there are only slightly more than 700 acres in total land area and that the majority of year-round homes are within walking distance of the ferry dock, the need for vehicles is not acute. However, the Council of Governments has projected a 2–3% annual growth rate in ferry vehicle trips through 1988. With an increasing percentage of salaried young professionals moving onto Peaks Island, the likelihood of this trend is reinforced.

Increased vehicle use will have many implications for quality of life on Peaks Island. Not only will gasoline imports to the island increase, but road deterioration will accelerate, vehicle emissions will increase, and land use patterns will be impacted. These effects may be manageable, but it is clear that alternative forms of mobility should be considered.

Space and hot water heating is another primary energy end use. Space heating is required during the late fall, winter, and early spring. With approximately 7,500 Heating Degree-Days (65°F Base), energy use for space heating can be substantial, especially in poorly insulated

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year-round structures. A rough estimate of space heating energy demands is as follows:

420 year-round homes x 1,400 square feet heated space/home x 8 Btu/Degree-Day/square foot x 7,500 Degree-Days/year divided by 1,000,000 Btu/1mBtu = 35,300 mmBtu/year

To get an idea of how much money island residents pay for this space heat on an annual basis, refer to Table 2 for the weighted average delivered energy cost for space heating and the calculation below:

35,300 mmBtu/year x $9.50/mmBtu = $335,000/year

This is admittedly a "back-of-the-envelope" calculation, but it provides a benchmark against which other alternatives can be evaluated.

Space heating requirements will increase as a function of new year-round housing construction and conversion of summer homes to year-round structures.

Water heating requirements vary directly with occupancy. Typically, a family of four requires 80 gallons per day of 120°F water. With a water source temperature of 55°F, the required temperature increase is 65°F for a total annual end use requirement of 16 mmBtu/year per household. With about 400 summer residences (4 months) and 420 year-round residences (12 months), total island water heating end use requirements amount to about 8,900 mmBtu/year. The exact percentage breakdown is unknown, but the predominant water heating energy sources are electricity and propane. Very few solar water heaters (active or passive) are in use on the Island.

"A new generation of light fixtures and appliances is now available with improved energy efficiency."

Cooking is not a large energy end use, but it is certainly important. With no pipeline natural gas available to the island, electricity and propane comprise the two cooking fuels. Other than appliance efficiency improvements, it is unlikely that any major changes will occur in providing energy for cooking needs.

Lighting, cooling, and motive power needs complete the list of energy end uses on Peaks Island. Lighting and cooling are powered exclusively by electricity, whereas motive power can be provided by gasoline, diesel, or electricity, depending on the application.

Energy Supply Infrastructure

Because Peaks Island is in such close geographical proximity to the mainland, the energy supply infrastructure has been extended to meet the end use needs. Liquid fuels, bottled propane, and cordwood are delivered by boat (or vehicle ferries). Electricity is transmitted from the mainland through a cable laid on the ocean floor of Casco Bay. These links provide the entire energy supply infrastructure to Peaks Island.

Bulk liquid fuels imported to Peaks Island include No. 2 fuel oil, diesel, various grades of gasoline, and bottled propane. These fuels are stored on the island and distributed by two local vendors at a 10 percent premium over mainland prices.

Cordwood is trucked to the island via the car ferry by individual homeowners and vendors. Cooperative bulk purchasing is a common practice in order to save a few dollars. At the present time, the city-owned forested park is not being used extensively for woodcutting. The reasons are not entirely clear, but it may be due to access and perceived availability.

Central Maine Power Company (CMP) is the investor-owned electrical utility that provides services to Peaks Island. An electric transmission cable installed in 1943 connects the CMP grid supply system with the Peaks Island distribution system. The cable enters Peaks Island at the substation erected next to a small 3 Mw diesel fueled, internal combustion, power generation station located at City Point. Under normal operating conditions, the generating station is shut down so electricity flows from the mainland to Peaks Island. Under certain peak or system emergency conditions, the diesel powered generators will be fired up to supply electricity to the New England Power Pool, of which CMP is a member.

CMP's system is comprised of a mixture of energy generation units including hydro, oil fired gas combustion and steam turbines, coal fired steam turbines, and diesel fired internal combustion units. CMP has a share in Public Service Company of New Hampshire's Seabrook 1 nuclear generating station. Due to Seabrook 1's financial difficulties, the Maine Public Utilities Commission may order CMP to terminate its involvement with Seabrook 1. Whether or not Seabrook 1 is completed and begins commercial operation, CMP rate payers can expect nuclear rate shock as at least a portion of CMP's invested costs in Seabrook will enter the rate base.

On another front, CMP was ordered by the Maine Public Utilities Commission (PUC) to develop rates and a system to purchase electricity from qualified cogenerators and small power producers as enacted by the Public Utilities Regulatory Policies Act of 1978. CMP established a decrement system using competitive Requests for Proposals issued to qualified and interested parties. Essentially, CMP has established base level avoided cost rates for each of five 50 Mw blocks of power to be purchased. Since the first 50 Mw decrement of purchased power enables CMP to avoid higher costs than the next and succeeding decrements, the base offering rate declines with respect to each decrement. Actual contracts are awarded to qualified parties on the basis of discounts offered to the base price and other technical, legal, and financial factors.

"... approximately 100 acres of city owned forested woodland could be managed as a producing woodlot."

Power production projects include small scale hydro, municipal solid waste to energy, wood fired cogeneration, and stand-alone, wood-fired electrical generators.

By early 1985, CMP will have contracted for close to 250 Mw of new capacity from existing businesses, municipalities, and energy project entrepreneurs. However, due to some of the difficulties inherent in CMP's contract conditions and the inexperience of some producers, many of these projects may not get off the ground.

Any proposal to generate electricity on Peaks Island must be based on one of three assumptions:

(1) Generated by a newly formed cooperative which sells directly to island residents;

(2) Generated by an entrepreneur for sale into CMP's grid under the decrement system; and

(3) Generated by a homeowner or business for individual use.

Each of these approaches must by necessity have an arrangement with CMP for either interconnection, backup service, use of distribution facilities, or a combination of the three.

Energy Conservation and Conversion Efficiency Improvements. It is common lore in energy circles that a dollar spent on conservation or efficiency improvement usually can "buy" more energy savings than a dollar spent on increased energy supplies. The basic argument is that individuals and firms don't consume energy directly; rather, they consume the end use services that energy can help provide such as lighting, mobility, comfort, and so forth. Therefore, rather than concentrating all efforts on developing new and renewable sources of energy to power inefficient conversion devices, one should invest some dollars to lower the energy use of the conversion device itself. The relative economic attractiveness of energy conservation measures has its limits, but few would argue that we have reached the crossover point from a social perspective in all sectors.

Turning to the Peaks Island situation, the most dramatic opportunity for efficiency improvements lies in the residential heating, lighting, and appliance end uses. While most everyone has probably made some degree of conservation improvement to their home, the condition of the island housing stock in general suggests that much more could be done economically. Areas for improvement most certainly include: caulking and weatherstripping; attic, floor, and joist insulation; use of storm windows, heat shrinkable window films, or insulated shutters and window coverings; wall insulation where possible; and careful attention to sources of infiltration or heat loss including vents, wall plug outlets, fireplace dampers, and so forth. In addition, air stratification devices and furnace checkups (replace air filters, cleaning burner tips, sealing leaks, and insulating duct work) can dramatically improve the energy savings of delivering space heat comfort to the home.

Water heating demands are influenced by water usage, water heater temperature set, age and overall condition, and tank heat losses. Installing low flow faucets and shower heads, reducing the temperature setting if possible, and using an insulating blanket around the tank can all lead to immediate savings. For new construction, one should consider the use of in-line demand water heaters, which heat instantaneously, thereby avoiding storage tank heat losses when not in use. Additionally, waste heat recovery devices are available which can be used effectively if the new home is designed with this in mind.

A new generation of light fixtures and appliances is now available with improved energy efficiency. Although each individual light or appliance may not use a large amount of electricity, substitution of these improved designs during normal replacement can begin to add up energy savings, especially when considered as a group. New high efficiency, long lived fluorescent bulbs for indoor use and high pressure sodium outdoor lamps can deliver many times the light output (lumens) per electrical input (watt) of incandescent lamps. Likewise, higher efficiency freezers, refrigerators, electric ranges, and dishwashers are all available for purchase. With the expected rapid rise in electricity prices in the CMP territory due to the rate basing of Seabrook 1 and 2 nuclear unit costs, investment in these energy efficient appliances will make added economic sense.

Turning to the transport sector, one finds a more difficult challenge to implement energy

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efficiency improvements. The most logical place to begin is to set in motion policies or opportunities which help displace the one person-one car mentality. A big problem, of course, is that individual mobility is viewed as a basic right. Any infringement upon that right must be justified very thoughtfully and persuasively. Energy savings alone will probably not be a sufficient reason to limit vehicle travel. As stated previously, growth in island vehicle traffic will have a range of impacts that will have to be contended with. It is only with reference to this larger set of issues that alternatives should be considered.

Obvious options that come to mind include greater use of bicycles during good-weather months, some sort of subsidized taxi service with an increased fleet of vehicles to provide more timely and frequent on-island service, and cooperatively or jointly owned vehicles for off-island use in order to minimize individual ownership costs. Any system based upon specific vehicle identification implies enforcement manpower and costs to ensure compliance. Such systems might include a vehicle tax based on weight or mileage, with revenues allocated to island road repair. Although such a system would not ensure that payment is directly proportional to use, it would at least have the benefit of preventing those without vehicles from paying for road repairs out of general taxes. Another system would be to limit the number of car ferries or dramatically increase the fare for non-commercial vehicles going from Portland to Peaks Island, while not raising the return fare. Using this "tax" approach is very efficient, in that those who most highly value island transport will pay for it. However, there is always the danger of pricing out those with very low incomes who have a valid need for vehicle transport to and from the island.

In terms of efficiency improvements, auto manufacturers have responded quite seriously to the increases in world petroleum prices beginning in late 1973. Clearly, consumers have demanded better mileage as is clear from the large market enjoyed by the efficient Japanese imports. Other than use of regular tuneups, there is not much that can or should be done on Peaks Island to speed the turnover to more energy efficient vehicles.

Island Based Energy Production. After conservation improvements, the next place to look for the development of a sustainable energy future is on the island itself. Of the entire spectrum of alternative energy resources, Peaks Island can only boast a few, and these are not available in either the quantity or quality to support all of the island's energy demands even after sensible conservation improvements are made. Not necessarily in order of importance, the available energy resources are direct solar energy, wood and woody biomass, organic and burnable municipal solid waste, and wind.

There is no significant **tidal flow** that could be harnessed near Peaks Island; nor does **wave energy** appear to be a viable long-term candidate because of the very high construction costs and low conversion efficiencies.

Direct Solar Energy can be used for space and water heating, greenhouse operations, aquacell waste processing through plant growth, and photovoltaic applications. With new island construction, efforts should be made to incorporate sun tempering with an upgraded energy conservation package. Where solar access is limited due to adjoining structures or parcel orientation, increased use of conservation would be warranted. Superinsulated construction techniques can reduce a home's heat loss factor to about 1.5 to 2.0 Btu/Degree-Day/square foot, four times less than is typical for the existing housing stock. In addition, attached multifamily units offer the advantage of shared walls, reduced heat loss, and possibilities for more efficient centralized space and water heating.

A number of retrofit greenhouses have been added to existing Peaks Island residences. These structures offer the multiple advantages of producing heat for the home, providing additional living space, and creating an interior environment for extending Maine's short growing season for plant and vegetable propagation. Many homes on the Island have the correct exposure for a retrofit greenhouse. The key to their increased use is that the perceived benefits justify the initial cost.

Another opportunity for use of solar energy on Peaks Island is domestic hot water heating. While the expense of active solar systems may not justify the investment, especially when the individual energy tax credit expires, there are cheaper thermosiphon designs that can be used in the cold Maine climate. One such system incorporates freon as the working fluid, which avoids the problem of freezing and the need for draindown.

The single largest impediment to the use of even the lower cost collectors is the high cost of

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Leslie Horst

money for financing which forces annual payments on a typical 5-year home improvement loan to be greater than the expected annual savings in utility bills. Again, however, one can expect retail electric rates to rise significantly in the coming years, which improves the long term viability of domestic solar hot water heating.

Rooftop photovoltaic systems are not expected to provide a long term viable substitute for imported electricity. Solar insolation falling on Peaks Island is limited due to the combined effect of latitude and the low percentage of possible sunshine (50-60%). However, if a new home required a lengthy extension of electric distribution lines which had to be paid for up front, photovoltaics could make sense. Conversely, if battery storage is insufficient to supply electric demands over an extended cloudy period, then a backup source such as a diesel generator would be required. For widespread PV use, electric rates would have to rise dramatically, and installed costs of photovoltaic systems would have to continue to decline.

Another island-based renewable energy source is **wood**. In the context of the team's recommendation for use of open space, approximately 100 acres of city owned forested woodland could be managed as a producing woodlot. With the thin topsoils that prevail on Peaks Island, an annual biomass growth estimate of 1.0 ton per acre per year is a reasonable yield assumption with a management program in place. The sustainable yield would amount to 100 tons per year or, at 2.5 tons per green cord, 40 cords per year. Earlier, the average existing home was assumed to use about 84 mmBtu/year of end use space heating energy. Assuming an aggressive conservation retrofit program, it might be possible to halve this to 42 mmBtu/year. With an improved wood stove heating efficiency of 65 percent, the required input energy for heating one home would amount to about 65 mmBtu/year or 2¾ cords of wood.

Therefore, even with intensive woodlot management, sustainable yields could provide all the space heating needs of only 15 homes on the Island, or 3.5 percent of total year-round dwelling units. Although the resource is not large, it does represent an underutilized resource, a source of part-time employment, and an annual gross revenue potential of about $5,000. With the many privately owned lots, it is possible that the acreage under management could be increased to about 150 to 175 acres, with a corresponding increase in available fire wood.

Municipal solid waste (MSW) is generated by homes and businesses on Peaks Island and must be dealt with. One option set forth by the Council of Governments in their 1984 evaluation of waste disposal alternatives is the installation of an incinerator on Peaks Island. From the viewpoint of sustainability, an immediate question is the extent to which energy recovery could be integrated into the incinerator design. For 1990, COG projects an average waste stream of about 7 tons/day during the peak summer months, 2 tons/day in the spring and fall, and 1 ton/day during the winter. In general, the simultaneous production of steam and electricity from MSW is not feasible with a waste stream under 100 tons/day. The Peaks Island waste volume is less than 1/10th this amount at peak, so such a design will not be practical in the foreseeable future.

Another potential would be recovery of direct heat through a heat exchanger. The energy contained in unsorted residential MSW is about 4300 Btu/lb. Assuming an annual baseload waste stream of 2 tons/day, the MSW energy content is 17.2 mmBtu/day. With a 60% combustion efficiency and 70% heat exchange efficiency, recovered heat energy would amount to about 7.2 mmBtu/day, or 2,520 mmBtu/year.

This recovered energy would be appropriate for use in heating a commercial greenhouse complex during the winter months or for processing hot water used in a canning or preserving operation, either of which could be sited in close proximity to the waste incinerator.

The final island based renewable energy resource potential is **wind**. A high elevation ridge line is located in the center of Peaks Island, providing the most opportune site for wind machines. Wind data from the Portland airport indicate average monthly wind speeds ranging from 7.5 to 10.0 mph, with the highest speeds occurring through winter and spring and maximums in November and March. Although wind speed data have not been recorded along this ridge top, one would expect the speeds to be higher than those prevailing in Portland because of elevation and exposure.

The ridge line would accommodate the siting of about six 50-kilowatt capacity wind machines. Assuming one of the machines is shut down for maintenance at any given time, 7 months with adequate threshold wind speed, and a mean instantaneous output of 20 Kw, the wind farm would produce approximately 500,000 Kwh/year of electrical output. If each of the 420 year-

round households consumed 8,000 Kwh/year, the coincident month electricity consumption would equal 1,960,000 Kwh. While the above calculations indicate that the potential for some wind energy production does exist, a look at the cost of generating this power shows that it would be much more expensive than electricity imports or diesel fired generation at the existing 3-MW facility.

Assuming an installed wind machine cost of $3,000/Kw, 10-year financing at 15% interest, 80% debt financing, and a 10% of capital cost charge for annual operation and maintenance labor, repairs, and administrative overhead, the busbar cost of electricity (without regard to energy and investment tax credits and accelerated cost recovery depreciation) is $.47/Kwh. The basic reasons for this high cost are the poor utilization of the machine stemming from the assumption of 20 Kw mean instantaneous output, and the expectation of only 7 operational months per year. If the six wind machines operated at the full 50 Kw rated capacity equivalent of five machines for 12 months of the year, the busbar cost would be reduced to $.107/Kwh. However, these favorable assumptions are unreasonable for Peaks Island.

These simple calculations demonstrate what is commonly observed throughout the country: wind energy systems will only be feasible where prevailing winds are sufficient in speed and duration and where avoidable electricity costs are very high. Unfortunately, the wind regime on Peaks Island is not believed to be sufficient for wind energy to be recommended as a viable long term electricity source. However, a detailed wind monitoring program is recommended along the ridge line above tree level in order to confirm this hypothesis.

In addition to the renewable energy resource potentials, Peaks Island could conceivably provide its own power needs through use of Central Maine Power's 3 MW diesel-fired internal combustion unit located at City Point. In actuality, the facility is comprised of three 1 MW units which presumably can be operated individually or combined to match island electric loads. At $1.00/gallon for No. 2 fuel oil (diesel fuel) and a 25% conversion efficiency, the energy cost alone of this power amounts to $.098/Kwh, well above the current *total delivered cost* of electricity to retail customers via the ocean cable.

If Peaks Island were to assume ownership of the CMP generating unit and distribution lines, it would have to form a separate legal entity, most likely a city approved island utility district or a customer owned cooperative. The advantage of forming such an entity would be to give island residents more autonomy in setting rates and establish some degree of independence from CMP and the mainland. The potential economic benefit would be based on the cost differential between the diesel fired units over CMP average future production cost including the rate basing on Seabrook Unit No's. 1 and 2 sunk costs. It is likely that this differential may never materialize.

The disadvantages would be several: the dependence of production costs upon the world price of petroleum over the long term and the vulnerability this implies; continued maintenance and spare parts requirements for units installed from 1942 to 1948; the requirement for overall management responsibility including operations, maintenance, meter reading, and billing; and the poor economies of scale obtained in these operations with such a small customer base.

Although separate operation of these units may look attractive from an independence perspective, the costs and risks probably don't warrant the investment, especially in light of activities within the larger CMP service territory and New England region.

Regional Energy Sustainability

Albeit indirectly, Peaks Island will benefit from renewable energy developments in the region in the years to come. For example, there are proposals outstanding to develop ethanol from imported corn, combustible fuels from peat, and electricity from small scale hydro, waste wood, cogeneration, and municipal solid waste. With an abundant Maine forest resource base, other potential technologies of the future include gasification, cellulose to ethanol (enzymatic or weak acid hydrolysis), and cellulose to diesel fuel conversion. Thus, the opportunities exist to help displace regional consumption of imported petroleum products and create a more dispersed and sustainable electric supply infrastructure. While many of these developments are not possible or appropriate for Peaks Island itself, Peaks Island will nonetheless be a beneficiary by virtue of its interrelationships with the regional energy infrastructure.

As stated at the outset, the search for a sustainable energy future on Peaks Island must not be limited to the concept of "cutting the cord." To do so would be to deprive local residents of the benefits that do accrue from Peaks' unique

urban island position within Casco Bay and the Portland City Limits. Common sense must dictate the approach to sustainable design; however, without the impetus of creative visions and the will to change, the opportunities for improvement that do exist will never be realized. It is hoped that this brief review of the Peaks Island energy situation will offer some departure points for further consideration and active participation by Island residents, city officials, design-in participants, and other interested individuals.

"The whole notion of a sustainable food system in the Northeast has been the focus of research, activism and debate involving hundreds of superb minds for at least 15 years."

Comments on Agriculture

Gary Hirshberg

Sustainability in the context of northeast agriculture is, at best, an elusive concept. It is important that we planners and thinkers remind ourselves that the whole question of sustainability is highly theoretical. Ultimately, any discussion of how to build a sustainable regional or local food system boils down to one of attitudes and behavior and of values and choices on the part of regional and local inhabitants. But before we get down to "ultimates", there are plenty of interesting intellectual exercises to tackle.

The agriculture component of our design weekend was an interesting exercise indeed. After a number of overview discussions and preparatory sessions, we were able to focus our design criteria on meeting a bulk of the food needs of these two distinct communities, Peaks and Vinalhaven. We assumed a mix of commercial and household agricultural enterprises and then plunged in. The results of these labors are in the report that follows.

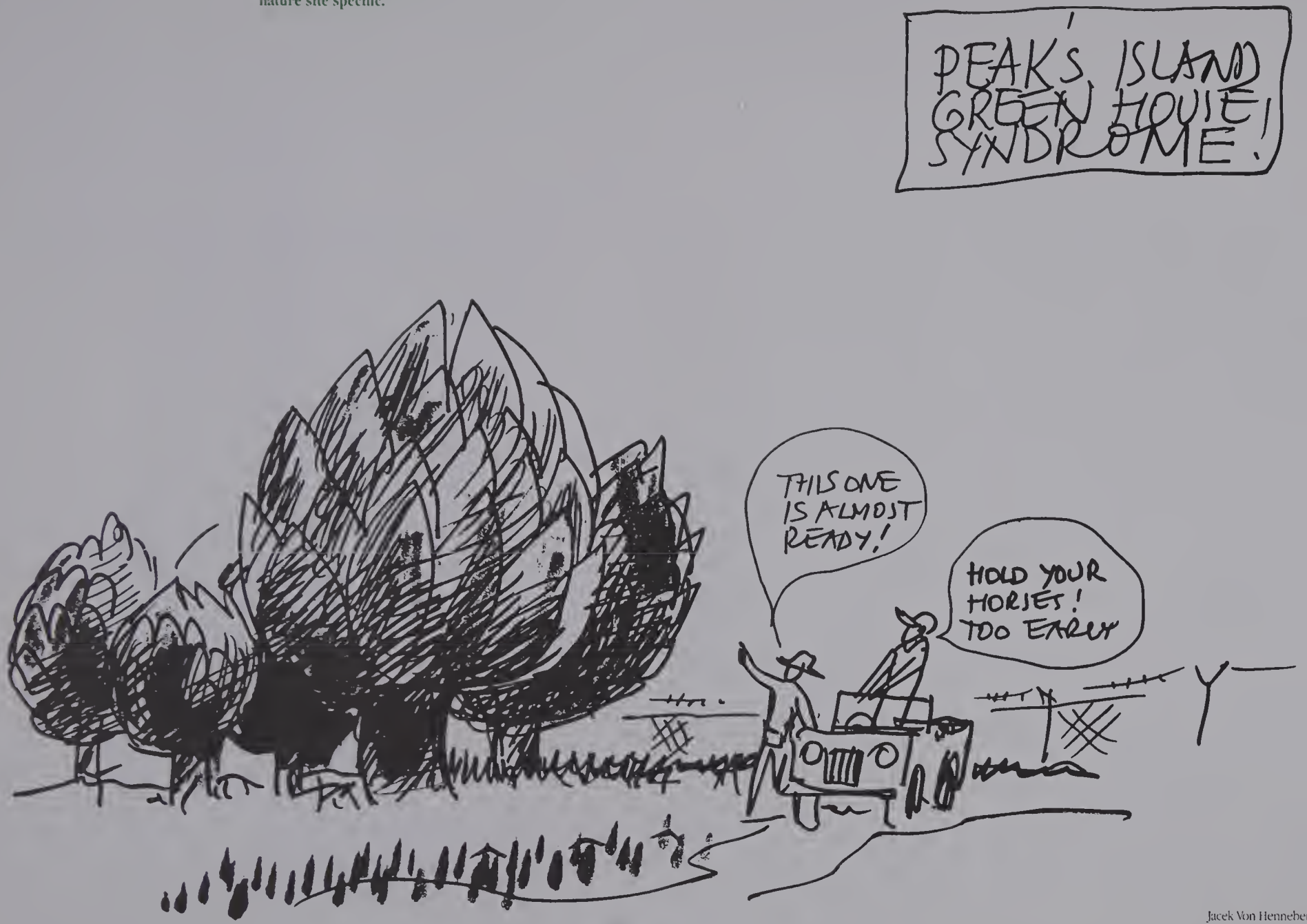
The whole notion of a sustainable food system in the Northeast has been the focus of research, activism and debate involving hundreds of superb minds for at least 15 years. What momentum has been generated around the topic is rooted in the awareness that we in the Northeast import 86-95% of our foods from distant lands, at an enormous energetic and economic disadvantage. As a region we are highly vulnerable to food system threats that have even earned the attention of the C.I.A. and we are beholden to a labyrinth of food processing and preserving techniques which pose serious questions of health. Superimposed on this awareness is the fact that the Northeast has in the past produced more than our share of diverse, wholesome foods in an industry that gave stability to our regional economy, and economic integrity and vitality to our rural areas.

"... we in the Northeast import 86–95% of our foods from distant lands, at an enormous energetic and economic disadvantage."

From these two places of unified opinion, the entire discussion has disaggregated into numerous disciplines and noble pursuits. There are the scientists and technicians exploring present and future pathways to better growing techniques. There are the food buying co-ops and clubs dedicated to supporting the shift to imported foods. There are the organic vs. ecological vs. regenerative agriculture buffs, and most of them disagree with the agribiz, chemical and high-tech proponents. And finally there are the hard-nosed farmland preservation advocates who are seeking to maintain at least a nucleus of farms on which to maintain some Northeast agricultural activity, if not to begin rebuilding a regional agriculture economy. From the perspective of our group of designers, the bottom line is that (a) there has been an enormous amount of vital and valuable thinking in this area from which to derive inspiration and information, and (b) the "discussion" has for the most part focussed on what the Northeast can do as a whole as opposed to what the role of a Peaks Island or Vinalhaven ought to be as an isolated part.

However, agriculture is by its very nature site specific. In fact, most of the major problems we are facing in our modern agriculture are due to our feeble attempts to impose general rules about soil fertility, pest control, animal nutrition, etc., on very specific situations. In general, the problems farmers are facing in our "modern agriculture" are rooted in our increasing distance between the grower and the land. The

"... agriculture is by its very nature site specific."



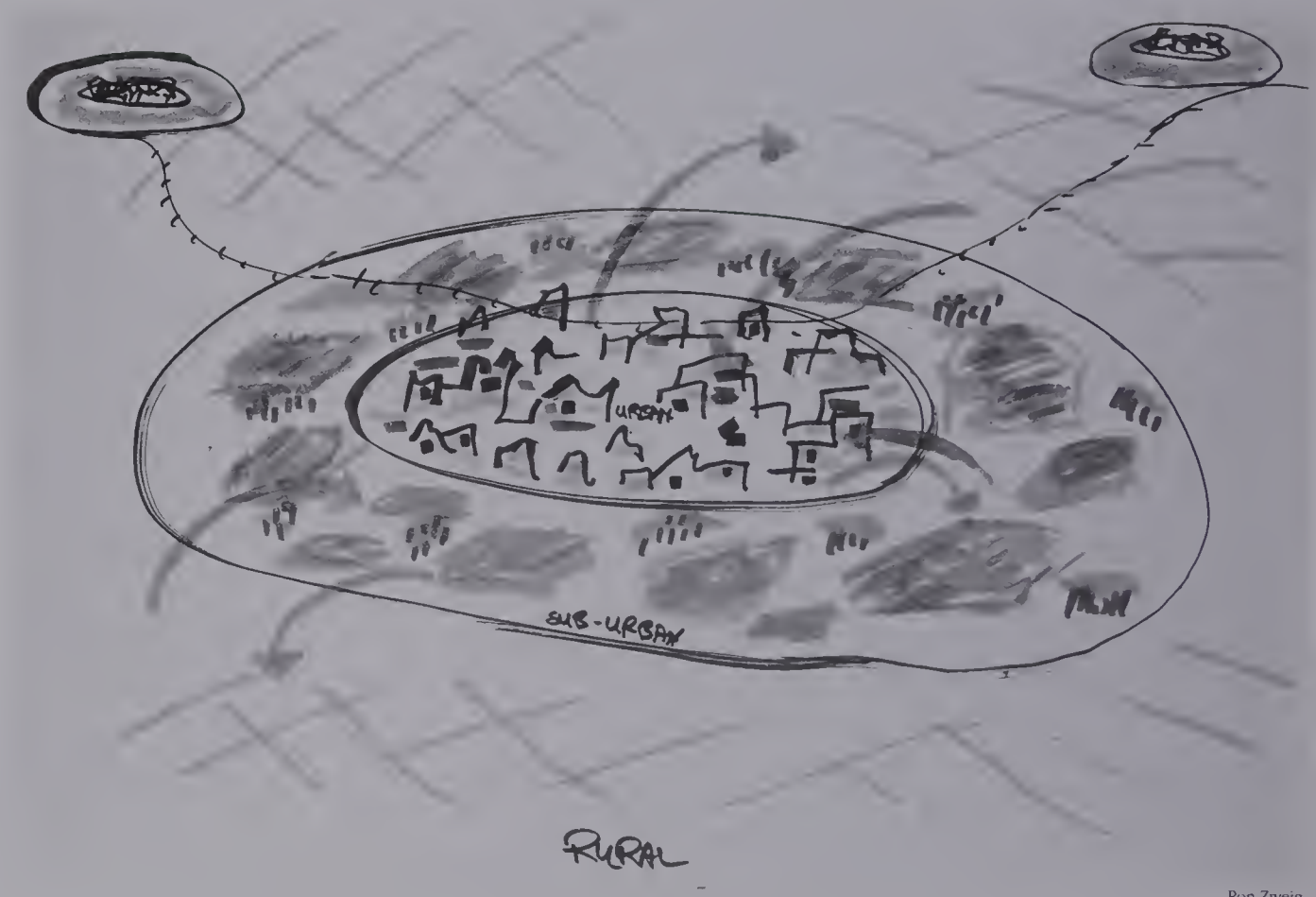
Jacek Von Henneberg

"We did not assume that these pieces of bedrock could meet all of their residents' food needs but we did set out with the goal of reducing food imports as well as providing some 'cottage industries' for residents."

"A solar greenhouse for season extension as well as for winter greens seems to be entirely practical and economical."

enormous investments in machinery, fertilizers, pesticides and herbicides that we've seen in the last 30 years have served only to cut the grower off from observing and reacting to the unique conditions of his or her site. By making it possible to cultivate more land with fewer people, we have sacrificed our own intuitive abilities, leaving key management decisions to expert technicians who prescribe singular linear solutions for complex, multivariate (and often cyclical) problems. Further, the net cost of investing in hardware and chemicals means that the farmer is caught in a debt cycle where each year's investment allows only the slimmest margin for keeping ahead of the creditors. The net result is a 225 billion dollar farm debt, and a rapidly deteriorating agricultural economy.

All of the problems in agriculture are not on the farm, and certainly the marketing and distribution dilemmas are as complex as the production problems. This is particularly relevant to any plan for new agricultural endeavors in the Northeast where markets must be clearly delineated and cultivated if there is to be any hope of competing with cheap mass market food imports. Clearly the answer to these two general problems lies in the question of scale when it comes to designing a new agricultural system. Both Peaks Island and Vinalhaven force one to design food production systems that are small and intensive, and both provide obvious and precise markets. We did not assume that these pieces of bedrock could meet all of their residents' food needs but we did set out with the goal of reducing food imports as well as providing some "cottage industries" for residents.



Ron Zweig

Ron Zweig's Donut Model of Waste Disposal and Recovery in China
(See Zweig Roundtable)

"The 'Peak's Pickle' was christened..."

While the soils on Peaks Island are primarily sandy and well drained, some of the topsoil development in the forest areas is nonetheless encouraging. We felt that a number of possible agricultural activities could be conducted using the sewage treatment plant as a source of nutrients.

(a) Community Gardens were the most logical activity, as many home owners do not have adequate space in their house lots. Moreover the cost-sharing advantages of a community managed operation can be very useful in terms of providing fencing and water delivery, avoiding vandalism, and marketing produce (a farm stand at the ferry, for instance).

(b) A solar greenhouse for season extension as well as for winter greens seems to be entirely practical and economical. We felt that an ambitious entrepreneur/grower could conceivably set up a small winter produce operation in cooperation with the island supermarket.

(c) A small community cannery would be available, again for the purposes of cost-sharing and socializing while preserving garden produce for family use or local sale and barter.

(d) On a very modest scale, tree farming seems quite possible, especially given that the woods are presently out of control with weed trees and "slash" that could be more efficiently managed. This would be an ideal activity for using excess waste matter and irrigant from the sewage plant. Wood chips could be a source of back-up heat for the greenhouses.

(e) Finally, while we carried no illusions that an island the size of Peaks could ever meet even its own food needs, let alone have excess for exports, we are aware that island residents could indeed produce several specialty items for sale in Portland. The "Peak's Pickle" was christened, pickling being a very easy and minimally space-intensive enterprise. Mushrooms can be cultured in the existing bunkers or in other dark, moist spaces. Many herbs grow naturally on Peaks Island and this could be a nice high margin activity. And, of course, there is always the dried seaweeds market, which while small could make for a supplemental income source.

In summary, we did not tackle the world's or even New England's or Maine's food system problems in this exercise. But, as the accompanying illustrations and narrative indicate, we did prove to ourselves that even these small pieces of land with their many stark limitations pose opportunities for meeting at least a part of their basic food needs. We in New England are fortunate in that the majority of our lands are in forests, which means that topsoils are being built. Peaks, too, has this resource advantage, and a few good agricultural entrepreneurs could probably turn it to their favor.

Tim Coppola

"... an infill development policy could accommodate a 50% increase in housing units above the current level of approximately 900 without dramatically affecting the current cluster pattern."

Summary of Recommendations

John S. Crowley

Introduction
These recommendations and guidelines are the culmination of both the Design-In held at Peaks Island and the roundtables convened at the BAC. Our work was guided by the following criteria:

1.
We wanted to prepare realistic and practical recommendations pertaining to sustainable coastal community development.

2.
Our particular focus was on solutions which encourage local economic development possibilities in balance with the natural environment.

3.
The project team elected solutions which reinforce the historical patterns of growth on the island.

4.
The underlying premise was to choose small scale and local solutions over large scale solutions, in keeping with our fundamental definition of sustainability.

5.
We tried to find solutions that would be intrinsic to the island situation, and we concentrated on what the future of island living might be like, not what it should be like.

Master Planning Recommendations
1.
Encourage year-round residents, to facilitate a less transient, more stable community. An increase in the number of all-year residents would be likely to bring about greater political autonomy for the island neighborhood. On the other hand, sustainable systems such as greenhouse food growing, nurseries and waste disposal can best support the summer population level. It is possible for the two to work together, with the all-year residents profiting from the summer tourists.

2.
Maintain the present historically rooted cluster development pattern, concentrated along the island's western and southern edges. The street and housing development pattern defines an almost natural boundary between the predominantly built and undeveloped portions of the island. An intelligently designed zoning statute could formalize the line and preserve this remarkable combination of land uses.

3.
Encourage new year-round housing and commercial buildings on those empty parcels that occur in the existing cluster development extending along the west and south edges of the island, i.e., infill development. Two of the expectable benefits are increased visual coherence of the community and a reduction in average walking distances to the ferry landing. The cost of improving community services – roads, power, water, sewer, waste disposal, etc. – would be kept to a reasonable level. Costly extensions to the utility umbilical cord would be held to a minimum, leaving a larger proportion of tax revenue for repair, maintenance and upgrading. Finally, the island's open space would be preserved without preventing growth.

This recommendation would help to maintain

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the present balance between open space and developed land, encourage small lot development, reduce the need to extend existing services, and provide a natural cap on population growth. Based on an analysis of existing land use maps, an infill development policy could accomodate a 50% increase in housing units above the current level of approximately 900 without dramatically affecting the current cluster pattern. Such an increase in housing units would result in an increase in the year-round population by an equivalent percentage or an increase from 1200 to 1800 residents.

The east side or "backshore" of the island, looking out over the Atlantic, has recently seen the construction of a few new homes. A small increase in the number of such houses would not be detrimental to the master plan. However, dense development of areas like the east side or the central section of the island should be avoided.

4.
Encourage multi-purpose zoning. Historically, many New England towns have had an intimate mixture of several land uses. This mixture is practical because owners can have shops in their homes; the European model where the shopkeeper or craftsman lives above or behind the shop suggests itself. This mix of uses is also visually and spatially attractive.

5.
Encourage the development of a stronger town center at the intersection of Island Avenue and Welch Street. The Peaks Island business zone suffers from a lack of identity and clear focal point. Future commercial development should attempt to provide a clear definition of the business zone, while encouraging and celebrating the pedestrian, and downplaying the role of motor vehicles. A tree-lined pedestrian promenade from the dock to Island Avenue would present a much stronger image of a quiet, rural community.

6.
Encourage modes of transportation other than the private automobile. Vehicle use on Peaks Island is essentially limited by virtue of need. Both Peaks' small land area (slightly more than 700 acres) and the proximity of most of the year-round homes to the ferry reduce the need for automobiles to the ferry.

Specific ways to encourage alternate transportation include: discouraging pleasure use of vehicles, taxing visitor vehicles (thus generating additional revenues to maintain the road system) and encouraging the use of bicycles, hand carts, mopeds and horse drawn vehicles. This last step would reduce road maintenance and require a more modest road system. Of course, roadways essential for emergency vehicle access should be maintained at a level that will ensure a timely response in an emergency.

Energy System Recommendations

1.
Plans for island energy utilization should not be based on the idea of "cutting of the cord" from the mainland. Even if this approach were technically feasible, it would not make sense in the context of Peaks' overall relationship with the rest of Portland.

2.
Increases in vehicle use should be kept to a minimum and alternative forms of transport should be encouraged. Options already in use that could be expanded include bicycles, taxi service, cooperatively and jointly owned vehicles, and garden carts. A vehicle tax based on weight or mileage with revenues going to island road repair would be a way to assure that those who use vehicles bear the cost for road repairs.

Another approach to limiting island vehicle use would be to reduce the number of car ferries or to substantially increase the fare for noncommercial vehicles arriving at Peaks from Portland, while not raising the fare in the other direction. In this approach those who most highly value island vehicle transport would bear the economic burden for the amenity.

3.
Residential heating, lighting, and appliance end uses provide an opportunity for significant energy savings. Much more should be done to improve the thermal integrity of the building envelope and equipment. Insulation, caulking, weatherstripping, setback thermostats, low-flow faucets and various approaches to reducing air infiltration are all examples of measures which have demonstrated economic benefit even in the short term.

To the degree that the recommended infill housing consists of attached multifamily units, there are potential further energy savings from shared walls, reduced heat loss, and more efficient centralized space- and water-heating. With the expected rise in electricity rates in the CMP territory due to rate basing of Seabrook 1 and 2 nuclear costs, investment in energy efficient appliances, hot water heating equipment, and lighting will make even more economic sense for Peaks Island residents.

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4.
Direct solar energy can be used economically for space and water heating, aquacell waste processing through plant growth, greenhouse operations and, in the future, limited photovoltaic applications. Retrofit greenhouses added to existing residences on Peaks Island provide multiple benefits: an extra source of heat; additional living space; and a possible extension of the short Maine growing season. Where they are feasible, their use should be encouraged.

5.
The 100 acres of city-owned forested woodland could be managed as a producing woodlot. However, it can only be expected to produce enough to provide all the space heating needs for 15 homes on the island. Although the expected total energy contribution is small, it would allow an underutilized resource to be used.

6.
Recovery of direct heat from municipal wastes through a heat exchanger should be explored, as it offers some potential. This recovered energy from incineration could be used to heat a greenhouse complex in the winter or heat water used in a canning operation during the summer.

7.
A detailed wind monitoring program should be conducted in order to test the hypothesis that Peaks is not an appropriate setting for significant use of wind energy.

Waste Management and Disposal Recommendations

1.
In order to ensure that at least primary treatment occurs throughout the island, a minimum treatment scenario was developed. All individual and city-owned systems would be required to include a septic tank treatment step before discharge to the ground or Casco Bay. Periodically, sludge would be removed from these tanks for final treatment and disposal. A major objective of the system would be to provide a final treatment method that returns the organic nutrients to the island's environment.

2.
We concluded that recycling is clearly the best overall approach to dealing with waste. In order for recycling to be economically feasible, the individual households must assume responsibility for the separation of materials. The key to a successful recycling program is the individual citizen as well as municipal participation and cooperation.

3.
Combining the two waste streams (solid and liquid) for treatment is the most important part of our recommendations concerning waste. We have made the assumption that citizens would be able – and willing – to carry out the required separation. An incinerator would be used for reducing the volume of plastic and paper which must be transported to the mainland. Composting of a combined mixture of sewage sludge and organic garbage gives island residents a means with which to improve the nutrient quality of their soil. During the summer, an aquacell treatment system would accept septage sludge from all island sources as well as rainwater runoff from the compost facility. Solid material that settled in the aquacell unit would be removed once a year for composting. During the winter, when there is not enough light to treat the

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PROPOSED DENSITY

waste water biologically, only a minimum flow from the composting and waste storage areas would be permitted to enter the aquacell. The balance would be contained in a holding tank.

Agriculture Recommendations
Establish a goal of reducing food imports and developing some agricultural "cottage industries." After lengthy discussions, the project team agreed that a number of possible agricultural activities could be conducted using the proposed waste treatment facility as a source for nutrients. The following opportunities offer the potential for local business development.

1.
A solar/waste heat driven greenhouse for season extension as well as for winter greens and herbs seems economically feasible. A small winter produce operation done in concert with the island supermarket could provide affordable locally grown produce year round.

2.
A small cannery or pickling plant could be operated as a cooperative for the benefit of all residents interested in preserving some of the summer produce for winter consumption.

3.
Herbs, specialty mushrooms, "the Peaks Pickle," dried seaweeds, and ornamental tree farming all offer the potential of high-margin small business activity for the ambitious entrepreneur.

Conclusion
In summary, we hope the ideas, suggestions and recommendations of the Design-In prove to be valuable and useful to the residents and policy-makers concerned with the future development of Maine's coastal islands, especially Peaks Island. Again, our goal has been to provide a longer range prospective on what island coastal communities might become during the next ten years. In retrospect, this investigation seems to have been quite timely given the increased level of interest of developers in the Casco Bay Islands.

Vinalhaven

Dick Morehouse

IX A Few Reflections on the Design-In

June, 1984

Herbert Gottfried

I have been studying (reading the literature, visiting sites) self-sustaining design and planning for a year. This fall I shall teach a studio in which students redesign an Iowa town (population 4,000) to be a self-sustaining community. So I came to Peaks hoping to experience my first "hands-on" sustainable environment and to look for ideas and methods that might be useful in design education.

Prior to coming to the island I had a pretty good idea as to how an individual structure (say, a single family unit) might be designed to be self-supporting. So I was especially interested in trying to understand community applications, since that seems to be the most effective way to introduce this kind of environment to the rest of the world. I wasn't disappointed in that Peaks and Vinalhaven were good locations, with a good mix of conditions, for this exercise.

My initial response to the design-in centered on the different approaches each team took in addressing the problem. It is unfortunate that each team did not have the same amount and kind of information (fewer materials were available for Vinalhaven), and site visits to both islands were not possible. These facts had an impact on the Vinalhaven group's analysis and subsequent decision making. However, even if adequate and equal amounts of data had been available, the two teams might have used the same approaches as they did; both were logical and well rooted in design practice. As a design educator and non-professional, I am more process than product oriented. Therefore, I found the Peaks Island group's method of analysis more appealing. I like the idea of using **"design as a means of inquiry"*** and using graphic techniques to reflect the inquiry.

The Vinalhaven group raised an interesting question for me. They attempted to focus on cultural and socio-economic continuities rather than biological/ecological ones. I have spent a lot of time during the past eight years identifying cultural resources, developing them as rehabilitated or reused resources, and advocating cultural tourism as part of economic development. After mulling this over, I have decided that the comparison of culture with biology is logical, but that culture is not equal to biology in that it is not systemic in the way that a balanced ecological system is systemic. Systemic balance in a natural/built environment would benefit from cultural and historic continuities, and over time, biological and cultural systems would reinforce each other. I suppose that once sustainability becomes a way of life, say in Vinalhaven fifty years later, the two systems would appear meshed, and the processing centers, distribution channels, production centers, and circulation systems would all be institutionalized.

The bottom line on sustainability seems to be biology. You need to emulate the natural system and integrate with the natural system in as efficient a manner as possible within the limits of the materials at hand. There is something interminable about such a system, like the rain that fell all weekend or the swell and pounding of the ocean. No matter what happens, the water keeps coming and going. There's a hum there; when you hear it or feel it you know the system is working. We can probably translate that hum into visual form.

A next to last note. Sustainability will probably work best at multiple, integrated scales, that is, Peaks' system would need to be part of Portland's and part of the Casco Bay Islands' system. Thus, bioregionalism is the next set of relationships that needs to be addressed. A sustainable unit cannot afford to be an atypical cell in a slice of tissues; it needs linkages to the other cells and to the organism at large.

Lastly, I personally enjoyed this experience. I especially liked the goodwill everyone exhibited toward these ideas. It's always a struggle to get students to suspend their disbelief. It was nice to see professionals do it so easily. I'll keep working with these ideas and hope to apply them to communities. Thank you all for the opportunity to make sustainability real.

* Margot Villecco's words for a study that she is conducting.

Herbert Gottfried, a professor in the College of Design at Iowa State University, has held a fellowship which he has used to study the concept of sustainable design. He attended the Design-In and was in a position to observe both design teams at work.

Peaks Island

Leslie Horst

X Acknowledgements

We owe thanks to many people who helped make the Design-In possible.

Well before the weekend started, several people put in many hours of preparation. **Tim Coppola** of TAC provided detailed and helpful maps, and **Kate Sherwood**, a BAC student, assisted with the preparation of the maps and other materials as well.

Many people contributed to the success of the weekend experience itself. **Ellen Klain**, of Peaks Island, did a superb job of coordinating local arrangements.

The Moonshell Inn provided attractive accommodations for some of our participants. The following people graciously opened their homes to our participants and added immeasurably to the personal dimension of the weekend experience: **Ruth Sargent, Nancy Hoffman, Richard and Ellen Klain, Jody Meredith, Fred Padula, Hazel Town, Maryanna Rowe, and Mary Alice Hayden.**

Several groups and individuals provided food – on time for our scheduled meal times, and delicious: **Peaks Island Child Development Center (John and Angie Kelso); Geffrey Vollers**; **Harbor Deli**; and the **Peaks Island Lions Club**. The people at **Feeney's Market** kept us supplied with liquid refreshments.

Peg Harmon and the others involved in preserving the Fifth Maine Regiment Community Development Center were helpful in facilitating our use of the building for the weekend.

Since the Design-In, we have received much help from several of the participants. We thank the many people who contributed their time and expertise in the preparation of this report.

We gratefully acknowledge a number of people and organizations without whose support this work could not have been achieved.

Bernard P. Spring, President of the Boston Architectural Center, and **Elsie M. Hurst**, Director of Administration at the BAC, have facilitated the accomplishment of this project.

The Architects Collaborative has contributed space and typing assistance for the preparation of this report. (**Laura Cushing**, secretary at TAC, typed the manuscript into the word processor in her "spare time" at the office.)

Dori Smith provided able editorial assistance for parts of the report.

Bernie LaCasse, graphic designer, has designed the medium which brings the message to life.

Finally, the **Bird Companies Foundation's** funding over a two year period has made the work of the Institute for Energy Conscious Design possible.

Leslie Horst

XI Appendix

Table 1 Peaks Island Low & High Population Estimates from Service Provider Estimates

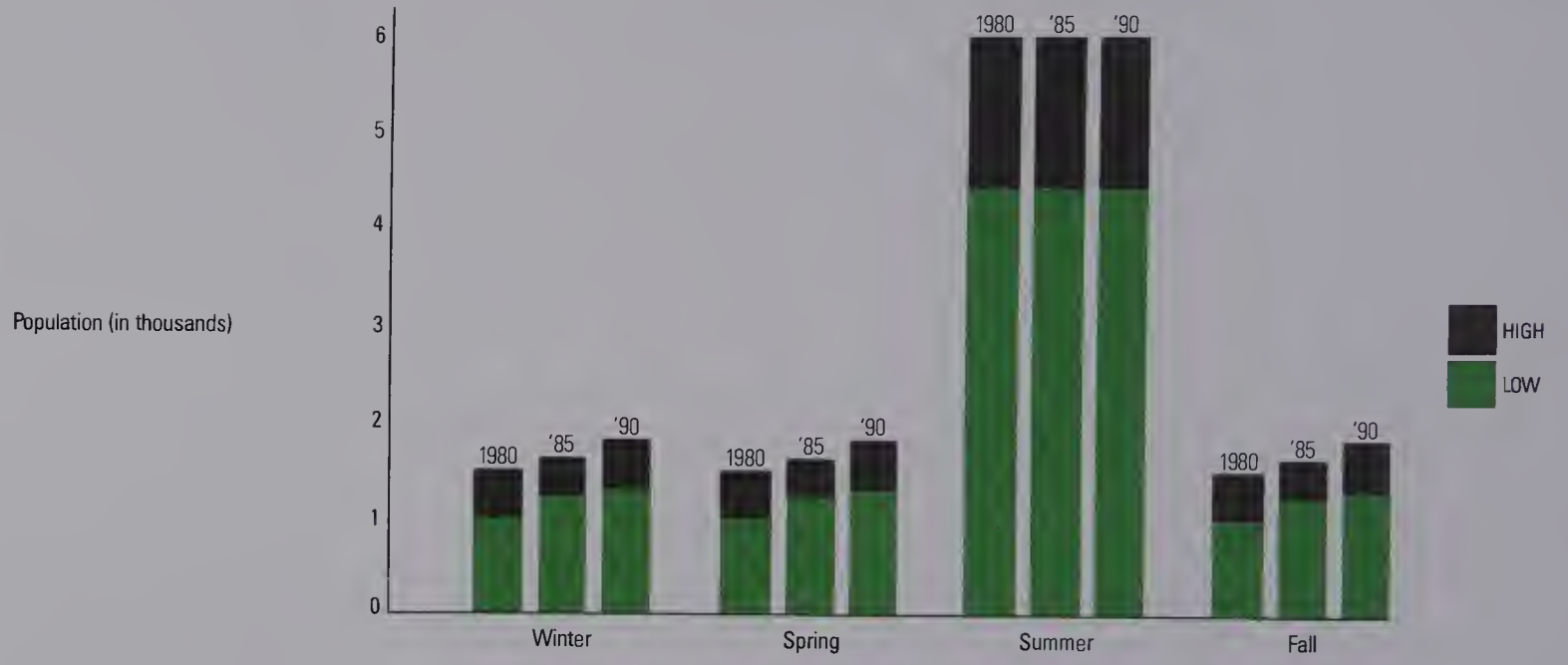


Table 2 The Islands Source: U.S. Census of Population and Housing

	1970	1980	Change	percent
Under 5	66	74	+8	12.1
5–9	81	71	−10	12.3
10–14	99	73	−26	26.2
15–19	77	72	−5	6.4
20–24	48	69	+21	43.7
25–34	70	192	+122	74.2
35–44	84	102	+18	21.4
45–54	94	93	−1	.94
55–59	52	70	+18	34.6
60–64	75	59	−16	21.3
65–74	121	106	−15	12.3
75+	71	83	+12	16.9
	938	1064	+126	+13.4

The 1980 population of The Islands was 1064, an increase of 126 (13.4%) since 1970. As shown on the table above, there has been a decrease in all age groups with the exception of the under 5 age group, the 20–44 age group, the 55–59 age group and the 75 and over age group. The under 5 age group is 7% of the population, the 20–44 age group is 34.1% of the population, the 55–59 age group is 6.5% of the population and the 75 and over age group constitutes 7.8% of the population. Combined, they constitute 55.4% of the total population of this neighborhood. The percentage of population in the dependent age groups (under 20) is 25.2% as compared with 26.5% for the City. However, the elderly population (over 60) is 23.3% of the total population of the neighborhood as compared with 21.3% for the City. The table above illustrates the population trends in The Islands by age group.

Table 3 Income Characteristics – The Islands

Mean Family Income	Mean Family Income Adjusted for 1979 Dollars*	Mean Family Income	No. Below Poverty Level 1979 Families	Persons
1969		1979	33	189
$6,842.00	$13,546.47	$13,171.00	12%	18.4%

*Adjusted for CIP, U.S. Department of Labor Statistics

Since 1969, the Islands have ranked 12th (of 13) of the neighborhoods measured on an income scale. The mean family income in 1979 was $13,171.00, $375.00 below the mean family income adjusted for 1979 dollars. It was well below the mean family income for the City of $19,054.00. 12% of the families in this neighborhood are below poverty level status as compared to the 10% below poverty level status in the City. 72% of these families are female headed with no husband present. Of the 266 families in this neighborhood, 24% had no workers, 39% had 1 worker and 36% had 2 or more workers.

18.4% of the persons on the Islands were below poverty level status in 1979 which is a 4% decrease over the ten year period. 19% of the labor force that worked with no unemployment in 1979 was male and 19% was female.

Table 4 Housing Stock Profile & Comparison to Mainland Housing Stock

A. Count of Urban Housing Units in the Islands

1960		1970		1980
1027	+325	1352	+150	1202

B. Number of Households Paying More Than 25% of Their Income for Housing Costs in 1979*

	Owners	Renters	Not Computed
	78	92	27
	26%	72%	6.3%
City of Portland	30%	56%	2.2%

C. Tenure and Occupancy Status by Year Round Housing Units

	Owner Occupied	Renter Occupied	Vacant
	318	127	283
	43%	17%	39%
City of Portland	39%	53%	7%

D. Total Occupied and Vacant Housing Units by Year Unit Was Built

	The Islands	City of Portland
1979 to March 1980	6.4%	1.3%
1960 to 1978	5%	17%
1940 to 1959	4%	18%
1939 or earlier	84%	56%

*Indication of Housing Distress

Demography

Table 5 Peaks Island Construction Activity
Source: City of Portland Building Department

Annual Dollar Volume	
1980	$245,800
1981	172,063
1982	155,350
1983	352,842
1984 Jan.–Feb.	27,000

Climate

Table 6

	Temperature						Precipitation			
Month	Average Daily Maximum (F°)	Average Daily Minimum (F°)	Mean Days/Month Max. to 90° or above	Mean Days/Month Max. to 32° or below	Mean Days/Month Min. to 32° or below	Mean Days/Month Min. to 0° or below	Normal Total (Inches/Month)	Mean Days/Month of Precipitation 0.01 inch or more	Mean Total of Snow and Sleet (inches/ Month)	Mean Days/Month of Snow and Sleet 1.0 inch or more
Jan	32	12	0	16	30	6	4.37	11	19.4	5
Feb	34	12	0	12	27	5	3.80	10	19.5	5
Mar	44	22	0	5	27	1	4.34	11	13.7	4
Apr	52	32	0	<1/2	15	0	3.73	12	2.9	1
May	64	42	<1/2	0	3	0	3.41	13	0.3	<1/2
Jun	73	51	1	0	0	0	3.18	11	0.0	0
Jul	80	57	2	0	0	0	2.86	9	0.0	0
Aug	78	55	2	0	0	0	2.42	10	0.0	0
Sep	70	47	<1/2	0	2	0	3.52	8	Trace	0
Oct	60	37	0	0	9	0	3.20	9	0.2	<1/2
Nov	48	29	0	1	20	0	4.17	12	3.3	1
Dec	35	16	0	12	29	3	3.85	11	13.5	3
Year	56	34	5	46	162	16	42.85	126	72.8	18

Table 7

Month	Wind		Sky Cover				
	Mean Hourly Speed	Prevailing Direction	Mean Days/Month Clear Daytime Skies	Mean Days/Month Partly Cloudy Daytime Skies	Mean Days/Month Cloudy Daytime Skies	Mean Days/Month Heavy Fog	Percent of Possible Sunshine
Jan	9.3	N	10	6	15	2	55
Feb	9.5	N	10	6	12	2	60
Mar	10.0	W	10	7	14	4	58
Apr	10.0	S	8	8	14	3	57
May	9.2	S	7	9	15	6	57
Jun	8.1	S	8	9	13	5	60
Jul	7.6	S	8	11	12	7	66
Aug	7.5	S	10	11	10	6	64
Sep	7.8	S	11	8	11	6	63
Oct	8.6	N	11	8	12	6	59
Nov	8.8	W	8	7	15	4	46
Dec	8.9	N	10	7	14	2	54
Year	8.8	S	111	97	157	54	59

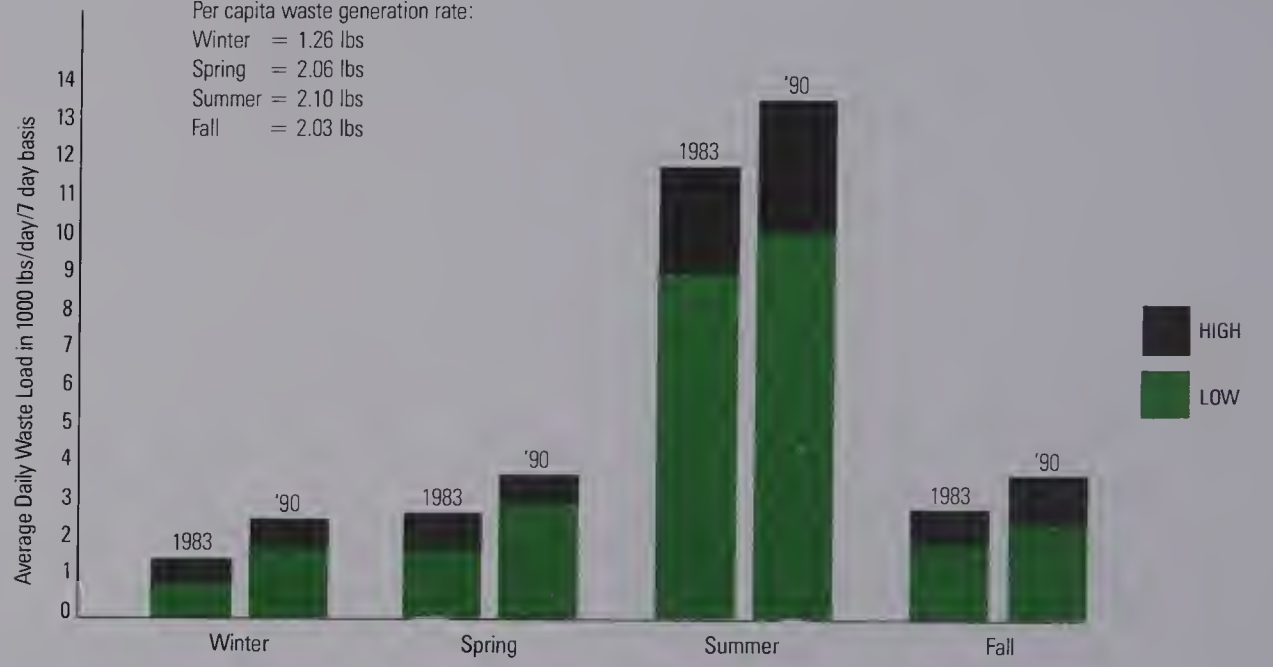
Table 8

MONTH	NORMAL TEMPERATURE (OEG F)* DAILY MAXIMUM	DAILY MINIMUM	MONTHLY	NORMAL DEGREE DAYS* BASE 65 DEG F HEATING	COOLING	TOTAL HEMISPHERIC MEAN OAILY SOLAR RADIATION BTU/FT2	KJ/M2	LANGLEYS
Jan	31.2	11.7	21.5	1349	0	450.3	5110.0	122.1
Feb	33.3	12.5	22.9	1179	0	681.9	7739.0	185.0
Mar	40.8	22.8	31.8	1029	0	969.9	11004.0	263.0
Apr	52.8	32.5	42.7	669	0	1303.9	14798.0	353.7
May	63.6	41.7	52.7	381	0	1567.4	17788.0	425.1
Jun	73.2	51.1	62.2	106	22	1711.6	19425.0	464.3
Jul	79.1	56.9	68.0	27	120	1659.1	18829.0	450.0
Aug	77.6	55.2	66.4	55	99	1460.9	16580.0	396.3
Sep	69.9	47.4	58.7	200	11	1157.8	13140.0	314.1
Oct	60.2	38.0	49.1	493	0	822.4	9333.0	223.1
Nov	47.5	29.7	38.6	792	0	459.3	5212.0	124.6
Dec	34.9	16.4	25.7	1218	0	362.9	4118.0	98.4
ANN	55.3	34.7	45.0	7498	252	1050.6	11923.0	285.0

Statistics from Portland Station #14764. Latitude: 43.39N Longitude: 40.19W Elevation: 19 feet. *Based on 1941–1970 period.

Table 9 Peaks Island Solid Waste Generation

Per capita waste generation rate:
Winter = 1.26 lbs
Spring = 2.06 lbs
Summer = 2.10 lbs
Fall = 2.03 lbs



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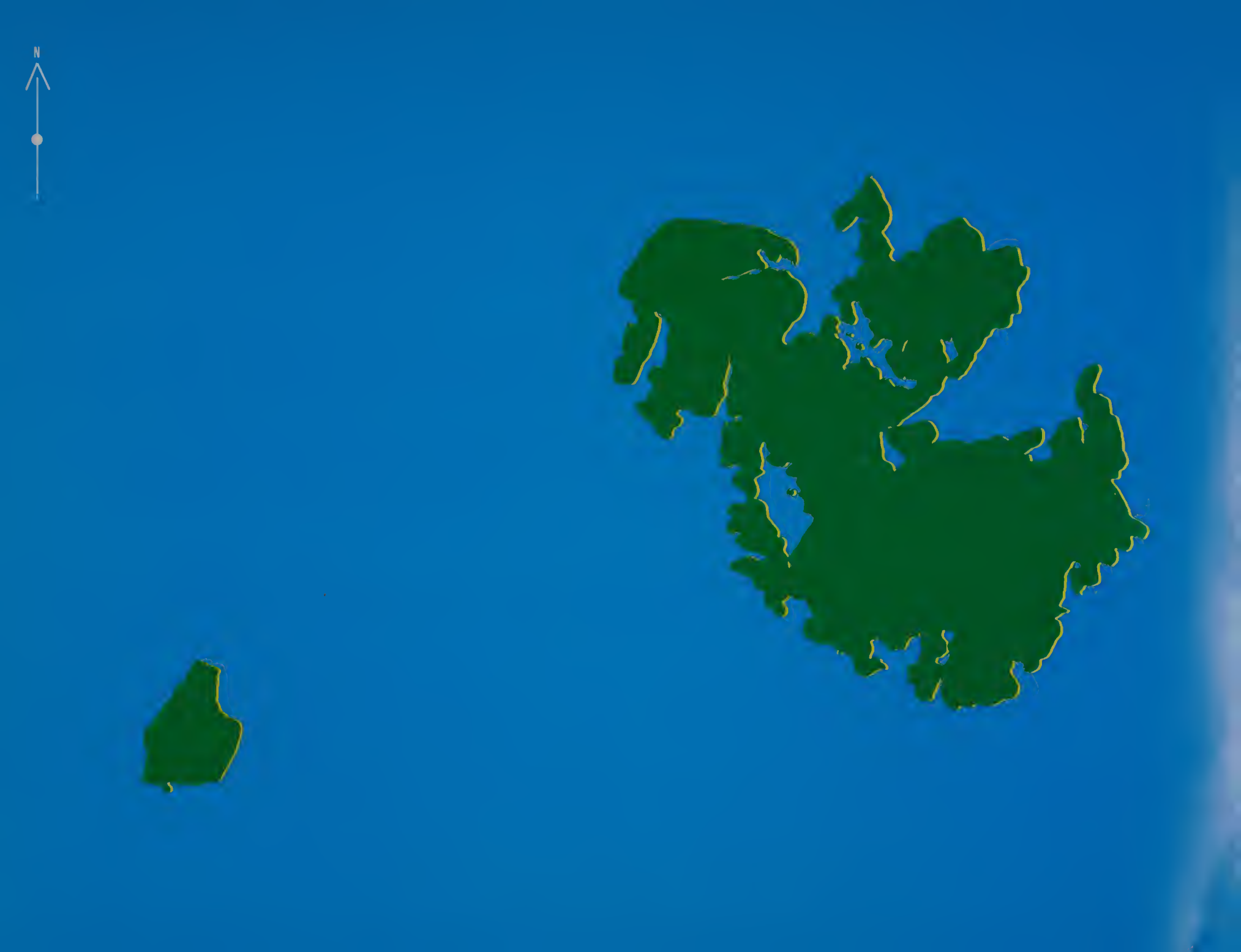
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